International
Marketing Information
Series

Global Market Survey

Electrical Energy Systems

GMS

U.S. DEPARTMENT OF COMMERCE
Domestic & International Business Administration
Bureau of International Commerce

International Marketing Information Series

This report is one of a series of Bureau of International Commerce publications focusing on foreign market opportunities for U.S. suppliers. The series is made available by the Bureau's Office of International Marketing in cooperation with the U.S. Foreign Service-Department of State. Most reports are based on research conducted by overseas contractors under U.S. Foreign Service supervision or by economic and commercial officers of the Foreign Service or Department of Commerce.

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As part of its marketing information program, OIM makes available to the U.S. business community, on a continuing basis, eight types of publications and reports.

1. *Global Market Surveys:* In-depth reports covering 20–30 of the best foreign markets for a single U.S. industry or a group of related industries.
2. *Country Market Sectoral Surveys:* In-depth reports covering the most promising U.S. export opportunities in a single foreign country. About 15 leading industrial sectors are usually included.
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6. *Overseas Business Reports:* Reports that include current and detailed marketing information on all of our leading trading partners. Most are revised annually.
7. *Foreign Economic Trend Reports:* Annual or semiannual reports prepared by the U.S. Foreign Service that cover, individually, almost every country in the world.
8. *International Marketing Events:* Brief market summaries in support of trade promotion events organized by the Office of International Marketing. Also, detailed calendars of upcoming events.

To supplement and up-date the marketing information available in this series, and for specific ordering information, we suggest that you telephone the nearest Department of Commerce District Office or the Country Marketing Manager responsible for the area or areas in which you are interested. A directory of these key people and offices is printed on the back cover.

Global Market Survey

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U.S. DEPARTMENT OF COMMERCE
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Office of International Marketing

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The Global Marketing Program

The Global Marketing Program is aimed at world-wide market penetration. It involves medium to long-term action by the Government in concert wtih 15 U.S. industrial sectors designated as "target industries".

The Program, developed and maintained by the Bureau of International Commerce, provides a wide range of U.S. government services focused on developing and expanding individual company export sales.

Fifteen American industries have been selected for inclusion in the Program. The industry selections were based on an assessment of their competitive advantages and growth potential in the world marketplace. The Office of International Marketing (OIM) solicits information and assistance from each key U.S. industry and related trade associations in planning the industry programs, in developing market research requirements, in selecting the country markets to be researched, and in determining the viability of Commerce-sponsored trade promotional events abroad.

A Global Marketing Program, combining the services outlined herein, is prepared for each target industry.

Target Industries

Avionics and Aviation Support Equipment (1975)
Process Control Instrumentation (1975)
Food Processing and Packaging Equipment (1975)
Air and Water Purification and Pollution Control Equipment (1976)
Laboratory Instruments (1976)
Business Equipment and Systems (1976)
Electric Energy Systems (1976)
Building Products and Construction Equipment (1977)
Communications Equipment and Systems (1977)
Computers and Peripheral Equipment (1973, 1977)
Health Care Industries Equipment (1973, 1977)
Graphic Industries Equipment (1974, 1978)
Electronic Industry Production and Test Equipment (1974, 1978)
Metalworking and Finishing Equipment (1975, 1978)
Electronic Components (1974, 1978)
(Actual and expected publication dates of Global Market Surveys for above industries in parentheses)

Global Market Survey

Foreign market research, conducted in 20-25 countries under the supervision of OIM and the U.S. Foreign Service—Department of State, is made available to U.S. firms in the selected industry. Additionally, a *Global Market Survey,* summarizing and analyzing the above comprehensive research, is published by OIM and distributed to U.S. industry.

Marketing Information and Counseling

Country Marketing Managers assist American companies in increasing their export business in specific countries and regions of the world by providing current marketing information and by working with individual companies in promoting their products.

Commerce District Office account executives provide Global Market Surveys to firms in the "target industry" and work with them in the preparation and implementation of individual company export marketing plans.

Trade Promotion Events

U.S. firms are invited to participate in a series of Commerce-sponsored commercial exhibitions, trade missions, seminars, and catalog shows scheduled for each industry. The U.S. Department of Commerce has been organizing these types of trade promotion events for U.S. industries for many years. The objective is to help U.S. manufacturers develop and increase their export sales. To obtain a copy of the schedule of upcoming events please write to the following address indicating the target industry of interest:

Office of International Marketing
Program Development, Room 4009
U.S. Department of Commerce
Washington, D.C. 20230

A schedule of other trade shows throughout the world sponsored by foreign organizations also is available by writing to the above address.

Below is a description of the types of trade promotion events organized by the U.S. Department of Commerce and the services available to U.S. participants:

Commercial Exhibitions at U.S. Trade Centers.—The first U.S. Trade Center was opened in London, England in 1961. There are now 12 U.S. Trade Centers around the world in which over 80 exhibitions of U.S. industrial equipment and products are conducted each year. Each exhibitor is furnished

with a fully constructed exhibition stand, furniture, utilities and janitorial services. A catalog of exhibitors and an exhibition brochure is prepared and delivered to sales prospects throughout the marketing area. An all-media exhibition promotion campaign is conducted by U.S. Department of Commerce trade promotion specialists. They make personal calls on key sales prospects, to ensure that all decision-makers for equipment (or product) purchases are invited to the U.S. exhibition. Shipping and marking instruction are provided to exhibitors so that exhibit items can quickly clear customs enroute to the exhibition.

U.S. Pavilions at Major International Trade Fairs and "Solo" Trade Fairs.—These exhibitions are organized and promoted in a manner similar to commercial exhibitions at U.S. Trade Centers, and U.S. exhibitors receive the same services from the U.S. Department of Commerce. Usually, U.S. pavilions are set up within major trade fairs in important foreign markets. On occasion, the U.S. Department of Commerce will independently organize a "solo" trade fair in a country where there is no U.S. Trade Center or major international trade fair but where prospects for U.S. exports are good.

Symposia and Seminars on Technological Developments.—These events are organized to introduce and explain new technology or new products to the market. The audience is comprised of engineers, scientists, technicians, managers, and directors from organizations which ultimately would purchase U.S. products incorporating the new technology. These events often are held in conjunction with commercial exhibitions or at meetings of professional organizations. Industry contributions are variable.

Trade Missions.—Organized either by the U.S. Department of Commerce or by an industry group or trade association, trade missions are supported by the Commercial Attaches at U.S. Foreign Service posts overseas. Appointments are made for mission members with important sales prospects and government decision-makers. Trade missions usually travel to several countries in a region with high sales potential for particular U.S. exports.

Catalog Shows.—These shows are organized by U.S. Department of Commerce and U.S. Foreign Service trade promotion specialists. Inquiries from prospective buyers and/or distributors are sent directly to each U.S. company promoting their products through these events.

Privately-Sponsored Events.—Single U.S. companies may hold product or service promotions in U.S. Trade Centers. These activities are sponsored, organized, and conducted by the companies themselves or their representatitves in the country.

Jeep.—Joint Export Establishment Programs (JEEP) are tailor-made promotions designed to help small groups of U.S. manufacturers of related products to inexpensively penetrate new markets on a shared-cost basis.

Please contact the nearest U.S. Department of Commerce District Office or the appropriate Country Marketing Manager listed inside the back cover for more information on these events.

Other Marketing Assistance

The Office of International Marketing is responsible for developing an effective foreign trade promotion program related to U.S. industry's needs in most U.S. trade areas. Other action units within the Domestic and International Business Administration (DIBA) include: the Bureau of East-West Trade and the Commerce Action Group for the Near East, concentrating special expertise and business services on the trading opportunities in their respective geographic areas; the Office of Export Development, providing vital data on export opportunities and on potential overseas customers; and the Office of Field Operations, delivering all of these services to the doorstep of the American businessman through 43 District Offices.

To make effective use of these and other services contact your nearest Commerce district office.

Major Foreign Markets for Electrical Energy Systems—an Executive Summary

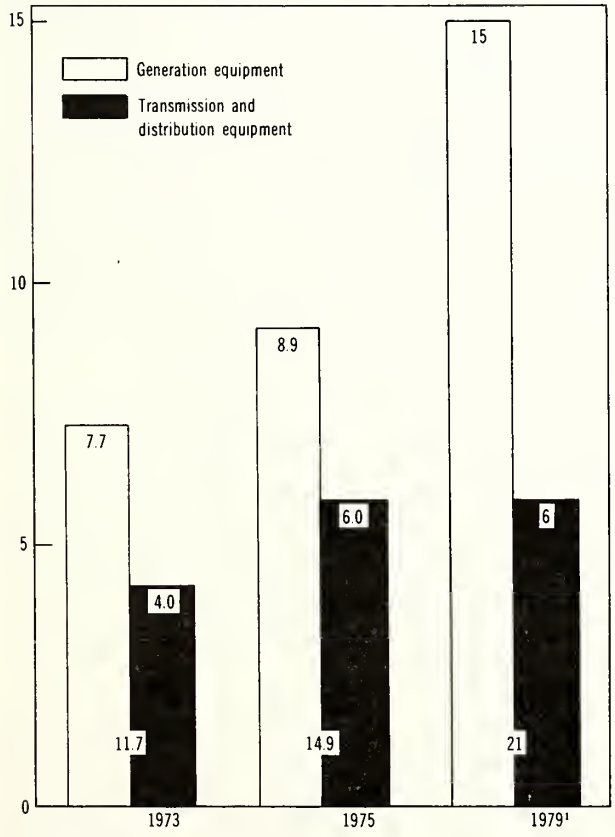
Increasing populations, rising standards of living and projected economic growth around the world will sustain an increasing global demand for electrical energy systems. A recent Department of Commerce study confirms a growing foreign market for generation, transmission and distribution equipment; sales in the 16 foreign countries surveyed are expected to rise from $15 billion in 1975 to over $21 billion in 1979 (see table 1 and figure 1).

Purchases of generation equipment in the countries surveyed totalled nearly $9 billion in 1975 and are expected to reach $13 billion by 1979. Through a variety of Five-Year Plans, developing countries continue to emphasize basic infrastructural development as a step toward modernization of their economies. Both developing and industrial nations have nuclear power plant construction programs aimed at reducing dependency on imported fuels.

Total investment by the surveyed countries in transmission and distribution equipment is expected to reach $8 billion in 1979, up $2 billion over 1975. Rural electrification will remain in high priority for developing countries and investment in extra high voltage (EHV) transmission systems is included in many expansion plans. Under the impact of environmental pressures, underground distribution systems, especially in metropolitan areas of Japan and Europe, are being increasingly used.

Figure 1: Total sales of electrical power equipment in 16 surveyed countries, 1973, 1975 and projected 1979

(in billions of U.S. dollars)



¹Excluding Mexico.

Source: Bureau of International Commerce, Office of International Marketing research study.

Competitive Assessment

Almost all large electrical energy equipment sold throughout the world is manufactured in the United States, Europe or Japan. Manufacturers within these areas generally dominate their respective country markets and leave little room for competition from abroad. Although many developing countries would like to establish a manufacturing capability either within their own borders or within the framework of a regional organization (such as the Andean Common Market), the expense of advanced technology and the small assured market awaiting the new industry will confine such manufacture to smaller, less sophisticated items for the foreseeable future. Because of this, these countries will remain strong import markets.

American-made electrical power equipment has a universal reputation for quality, reliability and advanced engineering. It generally is priced competitively with other makes and offers good parts supply and back-up service. U.S. companies find their best markets for advanced generating equipment, although demand for EHV transmission also could bring increased foreign sales opportunities to U.S. firms.

U.S. manufacturers of generation, transmission and distribution equipment supplied almost one-third of total 1974 imports in the 16 surveyed countries (see table 2). The highest growth markets for U.S.-made equipment are the developing countries, whose demand for electrical power has been estimated to double every 5 to 8 years. Their needs go beyond individual power equipment to include entire turnkey projects and consulting and contracting services. U.S. suppliers find that highly advanced

Table 1.—Expenditures for electrical energy systems by surveyed countries, 1974 and projected 1979
(in millions of U.S. dollars)

	1975	1979
European countries:		
Belgium	353.0	450
France	1,205.5	2,100
Germany	4,663.0	6,140
Italy	654.0	893
Netherlands	635.0	982
Spain	1,439.0	2,536
United Kingdom	812.0	769
Non-European countries:		
Australia	263.1	342
Brazil	427.1	628
Colombia	49.9	70
Indonesia	173.5	197
Iran	469.4	771
Japan	2,941.7	4,446
Korea	388.5	725
Mexico	170.0	N.A.
Taiwan	231.6	260

technologies, consulting services, and instrumentation have the strongest market potential in these markets.

American-manufactured electrical energy systems and equipment considered to have the highest worldwide market potential include:

Power boilers
Gas turbine generators
Turnkey nuclear power generation systems
Portable generator sets (all sizes)
Switchgear
Distribution and power transformers
All types of measuring and test equipment

Non-European Markets—In almost every developing country surveyed, American manufacturers hold a significant, and often leading, portion of the power generation equipment market; the share tends to be somewhat lower for transmission and distribution equipment. Traditional patterns in international sales of electrical power systems change slowly. A prime factor in buying decisions is the necessity to buy equipment compatible with existing installations. As the technology and construction specifications of equipment differs somewhat from one manufacturing country to another, importers of energy systems tend to order equipment from one national source. Former British possessions such as Australia still buy a large proportion of their equipment from the United Kingdom, and some Asian countries—Korea and Taiwan, for example—with long standing ties to the United States favor American-made machinery.

In recent years Japanese manufacturers have made considerable inroads in most Asian markets. The traditional U.S. markets of Latin America have seen some major sales by foreign competitors. Aggressive marketing has brought a sizable part of the Mexican market to Japanese suppliers, and Brazil's agreement in 1975 to purchase eight German-designed nuclear reactors will open the considerable Brazilian market to European competition. U.S. suppliers also hold a sizable share of the Japanese import market. Although imported equipment accounts for a small portion of the total market, about 75% purchased is of U.S. origin.

Throughout the emergent market countries U.S. made equipment is competitive with that of other developed countries in quality, servicing, and price. Financing terms and the need for special, customized features are the most often cited factors in choosing another national make. Several markets, such as Colombia, report that a larger U.S. share of the market could be achieved through more extensive sales contacts with local contractors.

Financing for large electrical power projects may be arranged through the World Bank Group or such regional organizations as the African Development Bank, the Asian Development Bank, the Inter-American Development Bank and others. Bids on projects thus financed are normally restricted to member-countries. Commercial nations generally have their own financing organizations and lending institutions to facilitate exports; the United States Export-Import Bank makes loans and guarantees in support of sales of American power equipment, including nuclear, and also for U.S. engineering and consulting services.

European Markets.—The larger European countries have their own electrical energy equipment industries, which have grown along with the nations' utilities and enjoy privileged positions in their respective markets. Many factors work to favor these

Table 2.—Imports of electrical energy systems to surveyed countries, 1974 and projected 1979
(in millions of U.S. dollars)

	1974		1979	
	total	*from U.S.*	*total*	*from U.S.*
European countries:				
Belgium	33.0	0.9	40.0	2.0
France	80.9	18.5	104.5	27.5
Germany	46.5	2.6	46.8	3.0
Italy	17.4	1.6	21.0	2.0
Netherlands	32.6	0.8	40.8	1.0
Spain	4.2	0.8	5.4	1.2
United Kingdom	111.4	26.0	122.5	23.0
Non-European countries:				
Australia	78.3	8.5	102.0	15.0
Brazil	165.3	57.2	249.0	70.0
Colombia	34.8	12.9	56.0	22.0
Indonesia	153.8	40.5	197.0	46.0
Iran	215.5	38.0	346.0	65.0
Japan	96.6	73.5	117.0	87.0
Korea	95.4	49.3	674.0	191.5
Mexico	68.3	45.0	92.0	46.7
Taiwan	87.0	50.4	175.4	85.5

"national" suppliers: (1) a unique set of electrical symbols, (2) national product standards—the German DIN, British Standard and Swedish ASIM standards; for example; (3) "buy national" policies of some countries; and, very importantly, (4) the buying habits of European purchasing engineers, strengthened by years of personal contact with company representatives and familiarity with a particular make of machine.

The giant European system manufacturers work in close cooperation with their utility customers. The most important are KWU and BBC (Mannheim) of Germany, and CGE and Jeumont-Schneider of France.

Other countries in Europe have large established generation systems industries—ASEA of Sweden is especially prominent—but these manufacturers are slowly losing ground in the international market in comparison to the French and German firms. The British and Italian industries receive many of their orders from uncertain domestic programs which are drawn up partly with the intention of furnishing contracts to domestic manufacturers.

Of prime importance to European manufacturers is the continued growth of the load; that is of government-supplied orders. Europe has just seen a remarkable period of purchasing, largely as a result of nuclear conversion by almost all national utilities. These orders will keep her companies busy to the end of this decade, but once this has passed the European market appears uncertain. Many countries, such as Sweden, plan drastic cuts in their growth of energy demand; the economics of nuclear power are still uncertain; environmental, safety, and other concerns cloud the future. (In Italy, ENEL, the national utility, has met resistance to its nuclear program from local governments that complain that nuclear plants require fewer employees than conventional ones.)

These developments will alter considerably the nature of Europe's power equipment market. Once the current surge of system orders passes, European manufacturers, their ranks possibly thinned, must compete for a new generation of electrical plant orders, for which U.S. firms could be in a more favorable competitive position.

Penetration by American equipment manufacturers into the relatively self-contained European market has not been significant up to now. U.S. nuclear generation technology has formerly been predominant in France but the French industry is now shifting from American-type BWR reactors to PWR such as are built in Germany. American investment in Spain has been considerable but has not led to significant increases in direct U.S. exports because of Spanish laws requiring at least 60% locally-manufactured products to be included in installations. Until now sales of electrical energy equipment in Europe by U.S. overseas firms have been largely confined to specialized products not elsewhere available. Major sales often have been made to U.S. overseas subsidiaries and other multinationals that do not habitually work to European rather than American technical standards.

Product Category

This study covers equipment and systems used in the generation, transmission and distribution of electical power. Generation equipment under 20,000 kw capacity, non-specific component parts (such as valves) and control and measuring instrumentation are touched upon peripherally. Contracting and consulting work is discused but not included in tables. The following Standard Industrial Trade Classification (SITC), Brussels Tariff Nomenclature (BTN) and Standard Industrial Classification (SIC) codes cover the bulk of researched equipment:

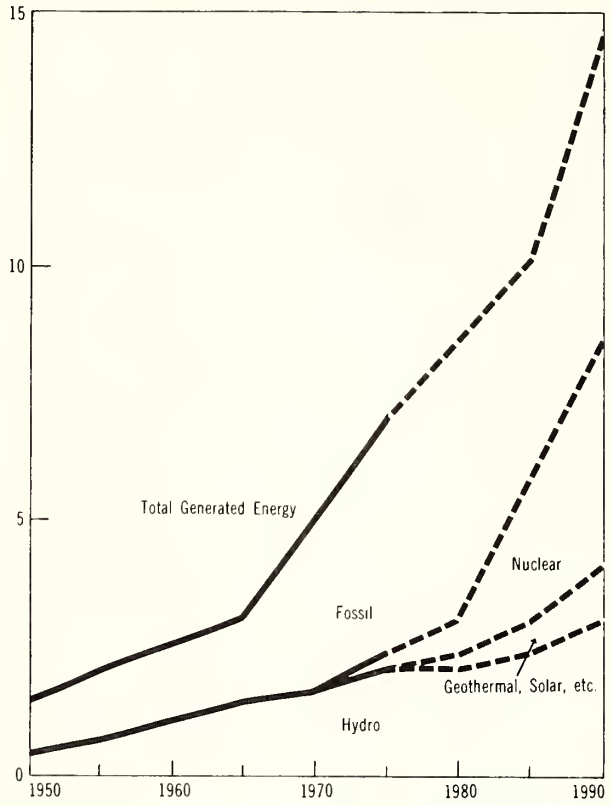
	SITC	BTN	SIC
Boilers, turbines, condensers and other equipment for steam and gas generation ..	711.1-3; 711.6	84.01-2; 84.04-5; 84.08B	34431; 34433; 3511; 36214
Nuclear reactors	711.7	84.59A	34433.39
Miscellaneous engines and generating devices (wind engines, water wheels, etc.)	711.8; 729.3	84.07/086; 85.21	3511; 36749.92
Diesel engines	711.5	84.06B	35193
Electric power machinery and components (switchgear, rectifiers, small generators, resistors, etc.)	722.1-2	85.01; 85.19	36122; 36132; 36135; 36137; 36292
Electrical measuring and controlling instruments	729.5	90.20/28A	36220; 38230; 38294
Engineering and design services	—	—	89112

End Users

Public utilities are the major end users of generation, transmission and distribution equipment. With the exception of Indonesia, utilities accounted for at least 70% of equipment purchases in every country surveyed and in some cases as much as 95%.

Figure 2: World generation of electrical power by fuel type, 1950-90

(in trillion killowatts)



Source: Reprinted from November 1, 1975 issue of Electrical World

These utilities spent $12 billion for electrical energy systems in 1975 and are expected to spend over $18 billion by 1979.

The relative importance of purchases of electrical energy equipment by industrial end users should decline in the coming years, although in some countries actual value of such sales will continue to increase. This overall decline in the industrial market has come about because electrical service in most developing countries is increasingly supplied by national utilities. In South Korea, for example, the single public utility generated 79% of the total 1972 demand for electrical power. By 1979, however, it is expected to supply 96% of the country's electrical requirements. Large private companies, especially those located in remote areas, still invest heavily in electrical generation equipment, and transmission and distribution systems because public utilities are unable to consistently meet their demands for electricity.

Spending by government agencies other than utilities, although a small part of the market, is expected to show steady growth. Governments will invest more in generation equipment than in distribution equipment, primarily to meet growing demands for health and education services and for the military. As an example, the Iranian Government has purchased 200 portable generating sets to power educational television broadcasts to rural villages.

Nuclear Generation and Other Trends

The petroleum embargo of 1973 and consequent price hikes gave considerable impetus to the installation of nuclear generating plants around the world. Since many countries fear future petroleum price hikes and are already operating at full hydroelectric capacity, they must turn to new sources of fuel. In the 16 countries surveyed, nuclear power made up 4% of total 1974 generating capacity. By 1980 it is estimated that nuclear power will supply 15% of Spain's capacity and over 25% by 1985, if current projections remain valid (see figures 2 and 3).

To increase energy self-sufficiency, many countries have turned to advanced methods of conversion from one type of fuel to another or from one grade of fuel to another, depending on domestic fuel availability. Germany, for example, plans to exploit its vast lignite fields. The use of lower grade fuel will in many cases require conversion of older conventional plants. Such conversions will generate sales opportunities for U.S. manufacturers and consultants.

Experimental forms of generation, such as solar, geothermal, and tidal, are viewed as intriguing but still impractical in most countries. Korea and France have plans to exploit limited tidal generation facilities and Italy plans to explore its geothermal potential but such projects are isolated examples. A more promising area of advanced technology is coal gasification and liquifaction. This would prove immense-

Table 3.—Generating capacity of surveyed countries, 1974 and projected 1980

(in gigawatts)

	1974	1980
European countries:		
Belgium	8.9	13.9
France	44.8	68.1
Germany	53.8	85.4
Italy	40.3	53.5
Netherlands	13.6	19.8
Spain	23.5	42.1
United Kingdom	65.0	70.0
Non-European countries:		
Australia	19.2	27.0
Brazil	17.4	29.6
Colombia	3.3	5.7
Indonesia	1.1	2.5
Iran	3.4	9.8
Japan	90.9	134.0
Korea	4.6	8.8
Mexico	8.4	20.9
Taiwan	4.4	9.6

ly practical to countries, such as Yugoslavia and Japan, which have large deposits of coal that are distant from generation plants. Computer control of plant operations and power grids is well-established in the developed countries and should soon become so in the rest of the world.

Many countries are looking toward extra-high voltage (EHV) transmission as a further aid to energy self-sufficiency. For example, one of the key points of the Brazilian government's energy policy is utilization of the country's vast hydroelectrical potential. However, in most cases new hydro plants will be located at remote distances from the principal centers of use. This will require Brazil to invest heavily in the most advanced EHV transmission and distribution equipment. U.S. EHV technology is among the most advanced in the world, and U.S. firms are in a good position to take advantage of this developing opportunity. Rural electrification programs in countries such as Indonesia and Colombia also will create a need for extensive quantities of transmission and distribution equipment. Industry opinion is universal that manufacturers of workable, reasonably-priced models of the above-mentioned systems would find a ready worldwide market. No country researched claimed the prospect of producing such systems in the near future.

Developing Markets

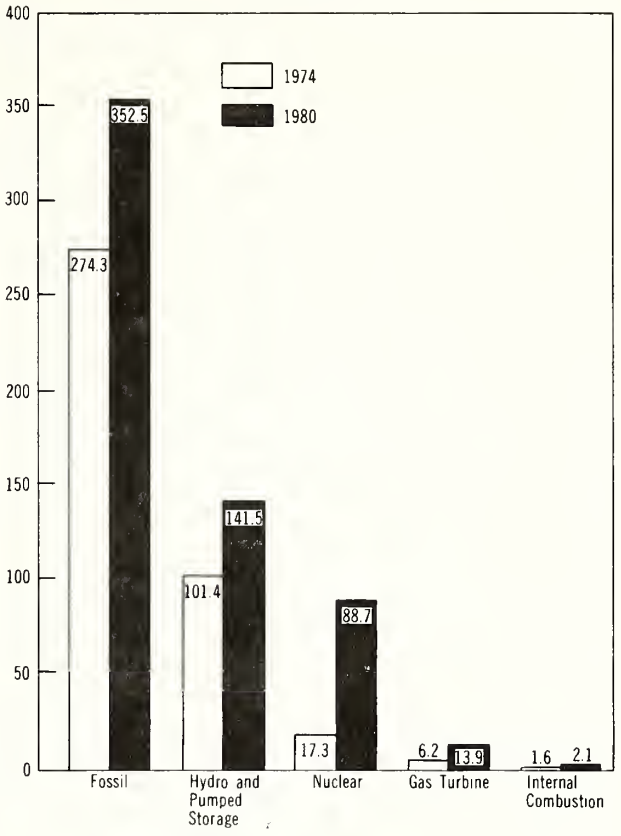
Expansion of national generating capacities, conversion to alternative fuels, construction of nuclear plants, and rural electrification plans all assure a healthy market in developing countries for U.S. manufacturers of power generation, transmission and distribution equipment (see table 3). Expansion programs in several of these dynamic markets are capsuled below.

Iran.—Under the impact of a comprehensive and ambitious development plan, demand for electricity in Iran is expected to grow 15 to 20% annually until the 1990's. As a result, Iranian generating capacity should increase four fold before 1985, reaching 16,000 MW. Construction of at least 20 additional power plants including at least six nuclear reactors will begin before the mid-1980's. By 1985 Iran will be spending an estimated $1.2 billion a year on generation, transmission and distribution equipment. The majority of expenditures on generation equipment will go for gas turbines and nuclear installations, all of which must be imported.

Korea.—Rural electrification and rapidly increasing industrial demand will drive capital expenditures by the Korea Electric Company and smaller utilities from over $600 million in 1975 to $1.2 billion in 1980 and double again by 1985. This should boost the country's total generation capacity from its 1975 level of over 5,000 MW to almost 75,000 MW by 1985. Nuclear, oil, and pumped storage plants

Figure 3: Total generating capacity of electric utilities in 16 surveyed countries, 1974 and projected 1980

(in gigawatts)



Source: Bureau of International Commerce, Office of International Marketing research study

will account for most of Korea's projects. Important construction projects include: Two 300-MW oil plants, each costing about $150 million; a 300-MW pumped storage system at a cost of over $80 million; and a 650-MW nuclear facility costing about $675 million. Foreign funding is involved in most of these projects.

Mexico.—Construction of power generation facilities in Mexico is planned to raise total capacity from slightly over 10,000 MW in 1975 to about 21,000 MW in 1980. Capital expenditures by the national electrical utility should reach over $200 million yearly by 1980 and over $300 million by 1985. Hydro plants will account for the largest part of this construction. The largest project of this type is the six unit complex at Chicoasen, planned to go on line in 1980. Coal-burning plants at Rio Escondido (two 300 MW units scheduled for completion in 1980) and Carbon (three similar units scheduled for completion 1981-83) will also add greatly to the country's generation capacity. Mexico plans to build four nuclear plants in the 645-750 MW range between 1979 and 1983. Imported U.S. equipment supplies a large portion of this growing market.

Indonesia.—The recently revitalized national util-

ity has undertaken an extensive program of consolidation and expansion that will push its generation capacity from 1,000 MW in 1974 to 2,500 MW in 1980 and 5,000 MW in 1985. The utility's capital investment will see unprecedented growth as a result. The 1975 investment level of $128 million should increase to about $210 million by 1980 and double 5 years later to over $420 million. Over 50 projects are being planned or considered. Among them are: two oil-burning units of 25 MW each to be constructed at Sulaiese late in 1978 or 1979, costing $25 million each, and a 400 MW hydro plant in Java starting in 1977 or 1978. It will cost $200 million and be partly financed by the IBRD.

Private industry until now has been a larger purchaser of this equipment than the utilities, and will continue to place large orders. International Nickel plans two 25-MW oil units and two 60-MW hydro units, all designed by Bechtel. Caltex will install almost 1,000 km. of 115 KV lines to its facilities in Sumatra.

Europe

The future of the electrical power generation industry in Europe is dominated by two major developments: The increasing integration of the continent's power grids and their eventual conversion to predominantly nuclear generation. These changes hold great significance for power equipment manufacturers on both sides of the Atlantic.

By the time the European energy systems market places its next large round of orders, it should be more or less a nuclear market. Countries relatively low in energy resources such as France, Spain and Germany have no other alternative to expensive, imported fuels. Spain is a country literally leapfrogging into the nuclear era. Almost bereft of untapped indigenous energy resources other than uranium, Spain has elected to undertake a nuclear program on a scale matched only in proportion to total demand by France and Germany. Over the next 9 years the Spanish government plans to invest an estimated $16 billion in nuclear power plants. Its goal is to supplant oil with nuclear energy as the dominant power source by 1985. Countries not building their own nuclear plants are expecting to buy power from their neighbors.

The electrical supply network of Western Europe can be expected to increasingly operate continent-wide rather than on a national scale. U.N. statistics show 37 international interconnections scheduled to come on line between 1972 and 1979 on the continent (both Eastern and Western Europe). One cooperative energy grid already connects Italy, Switzerland, and Austria. The Kalken station is a joint effort of four countries. The Chooz plant is a joint effort of France and Belgium. Norway transmits some of its power through Swedish lines. Transnational cooperation must be the future of the European energy system as demand grows. Countries with relatively limited resources such as the Netherlands and Denmark frankly will have to rely on such a system.

Summary

Today, third-world countries offer a more lucrative market to U.S. suppliers for electrical energy systems than European nations. The reason is many of them are just entering the market for large-scale energy systems. Sales made to these markets now could easily propagate themselves with every expansion and replacement order. European sales, on the other hand, probably await U.S. manufactures in the next decade.

The U.S. Department of Commerce offers a variety of services including background information on foreign companies, lists of potential foreign customers and overseas exhibitions and seminars, designed to facilitate export efforts by American manufacturers. These services are described at the end of the Global Market Survey. A list also is given of the Department's 43 District Offices located throughout the country; trade specialists in these offices assist businessmen both in regard to Department services and in securing helpful commercial information.

Country Market Surveys

Country Market Surveys describe the market for electrical energy systems in 16 selected countries. They are based on research conducted in each country for the U.S. Department of Commerce, Office of International Marketing by private market research companies or by commercial sections of the U.S. embassies.

Each Country market survey discusses:

Market Size

- Size of market for generation, transmission and distribution equipment (historical, current and projections of the future) and key market trends.
- A brief description of prospects for U.S. contractors and engineers.

Competitive Environment

- Importance of imports vis-a-vis domestic manufacture in supplying the market.
- Market position of U.S. manufacturers.
- Review of domestic and third-country competitors.
- Information concerning technical standards, tariff rates, marketing channels and other factors affecting importation of power equipment.
- Role of foreign contractors and engineers in construction projects.

Major End-users

- A description of the country's electric power utility, including its structure, resources and construction plans.
- Energy equipment needs of the country's industries and government agencies other than utilities.

Advanced Technology/New Sources of Energy

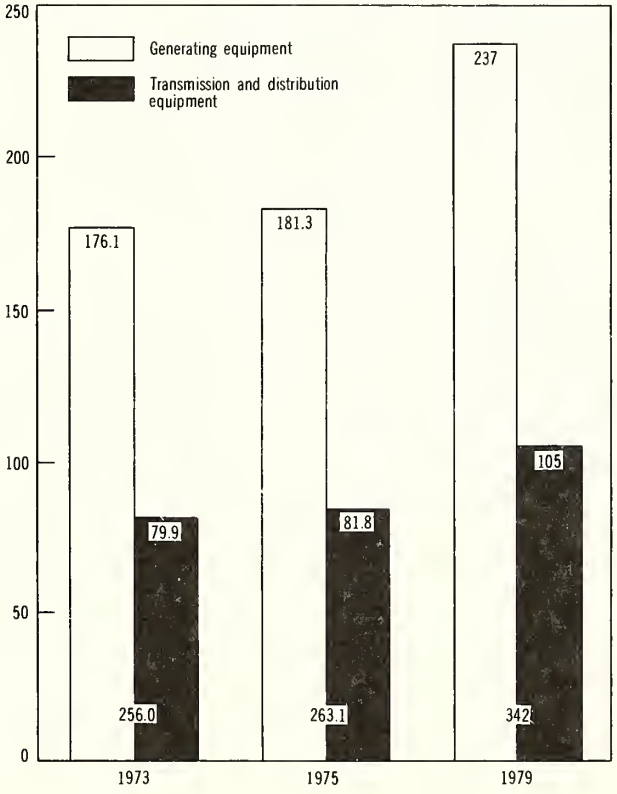
- Important research being conducted in the country and possible developments in the industry.

Electrical Energy Systems
Australia

Spurred by large equipment purchases for power plants already under construction and for major projects slated to begin in 1977-78, the Australian market for electrical generation, transmission and distribution equipment should return to the pattern of steady growth it experienced at the beginning of the decade. Sales of electrical energy systems grew well over 16% a year from 1972 through 1974, when total receipts reached $282 million [1] (see table 1 and figure 1). Expansion was interrupted by the worldwide recession in 1974 and 1975, but trade sources anticipate economic recovery and expansion through the rest of the 1970's which could bring the power equipment market to almost $350 million in 1979.

Figure 1.—Australia: Total sales of Electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study; values based on official Australian statistics and trade source estimates.

The pace will be set by generation equipment, which presently accounts for over two-thirds of the total market. Sales are forecast to climb from $181 million in 1975 to $237 million in 1979. In the same time period, investment in transmission and distribution equipment is expected to expand from $81 million to $105 million.

Australian utilities account for over 80% of total market sales. They anticipate a 6% annual load growth over the 1975-85 period, and their expenditures for electrical power equipment are expected to increase, reaching $277 million in 1979. Purchases of generating equipment, which account for about 70% of the utilities' equipment budgets, are forecast to reach $195 million in 1979.

Industrial sales make up about 14% of the market. Industry's purchases of power equipment are projected at $47 million in 1979. The Government (excluding utilities) accounts for about 5% of the market. Demand from this sector, which primarily reflects the electrical power requirements in the territories, is expected to reach $18 million in 1979.

Sales opportunities for generating equipment will expand substantially during the next 5 years, led by power boilers (including parts and accessories), steam and gas turbine generator sets, and motor and diesel generator sets. In transmission and distribution equipment, switchgear, large power transformers, and circuit breakers (especially those insulated with SF6), will offer exceptional prospects.

[1] All statistical figures in this survey are presented on an Australian fiscal year (July-June).

Table 1.—Australia: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	110.3	143.2	159.2	149.5	195
Transmission and distribution equipment	56.9	62.7	68.9	64.5	82
Total	167.2	205.9	228.1	214.0	277
Industrial companies					
Generation equipment	20.8	25.5	26.2	23.4	31
Transmission and distribution equipment	10.5	12.7	13.6	12.2	16
Total	31.3	38.2	39.8	35.6	47
Government (other than utilities)					
Generation equipment	5.4	7.4	8.8	8.4	11
Transmission and distribution equipment	3.4	4.5	5.5	5.1	7
Total	8.8	11.9	14.3	13.5	18
Grand Total	207.3	256.0	282.2	263.1	342

[1] All figures converted at the following rates: 1972—US$1=Aust. $.840; 1973—US$1=Aust. $.706; 1974—US$1=Aust. $.671; 1975 and thereafter—US$1=Aust. $.763.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Australian statistics and trade source estimates.

Sales of U.S.-origin power equipment of all kinds totaled $8.5 million in 1974. Opportunities for American suppliers are greatest in generating equipment. Potential sales for such U.S.-made goods are forecast at $12 million in 1979, but even higher levels are likely if manufacturers in the United States bid successfully for major utility power plant contracts.

Competitive Environment

The Australian market for electrical energy equipment is highly competitive. Table 2 shows that most of the world's major manufacturers participate through imports or local production. Domestically manufactured equipment served 75% of Australia's needs in 1974, but a greater dependency on imports is expected during the remainder of the decade. Imports will supply about 30% of the total market in 1979.

Imports.—Australia's imports of electrical power equipment exceeded $74 million in 1973, declined slightly in 1974 to just over $71 mililon, and are expected to reach $102 million in 1979 (see table 3). Generation equipment accounted for over 70% of total power equipment imports in 1974, with turbine generator sets considered the major imports in this category. Sales of imported transmission and distribution equipment are forecast to reach $25 million in 1979. Switchgear, power circuit breakers, relays, and large transformers are the major items of interest.

Long-term growth prospects for imports are excellent. Rising labor costs in Australia have weakened the competitive position of some domestic manufacturers of transmission and distribution equipment, and as a result, more imports of power circuit breakers and switchgear are anticipated in the latter part of the 1970's. Moreover, for many advanced types of equipment, the Australian market is too small to support full domestic production; consequently, trade sources anticipate growing imports of technologically advanced equipment and components as the power industry expands.

U.S. suppliers generally provide 10-15% of Australia's imports of electrical power equipment. With sales of $8.5 million in 1974, American manufacturers served about 3% of the total Australian market; their overall porition is expected to improve by 1979. Imports from the United States are forecast to reach $15 million in 1979, or approximately 4% of the total market.

Most of this growth can be attributed to purchases of generating equipment (typically about 75% of the U.S. total). These sales are forecast to double, from $6 million to $12 million, between 1974 and 1979, expanding the market share held by U.S. generation equipment suppliers from about 3 to 5%.

American manufacturers of transmission and distribution equipment registered sales of $2 million in 1974 (11% of the import market). Although they are likely to face intense competition from other foreign suppliers over the remainder of the decade, U.S. firms are expected to increase such sales to about $3 million by 1979.

U.S. companies have been particularly successful selling generation, transmission and distribution equipment to Australian power equipment manufacturers. They are the principal suppliers of motor generator sets, gas turbines, power boiler parts and accessories, circuit breakers, and switchgear. Governmental (other than utilities) and industrial end users have also been a source of sales success. Further sales opportunities can be expanded by assuring that equipment meets specification requirements and is suitable for the electric system in Australia, and by bidding competitively against third-country suppliers. Trade sources also predict that the introduction of nuclear power technology in Australia would vastly enhance the opportunities for U.S. sales to the utility sector.

The technical quality and reliability of American equipment are widely respected in Australia. Sales prospects for U.S. suppliers are expected to increase notably toward the end of the decade, with recovery and expansion of industrial and mining activities. Good sales opportunities exist for U.S.-origin generation equipment, particularly steam turbine (500-MW), gas turbine (10- to 60-MW), and

Table 2.—Australia: Major suppliers of electrical power equipment

Domestic manufacturers

Westinghouse Electric Australasia Ltd. (subsidiary of Westinghouse Electric Corporation, U.S.)
Motors, transformers for special industrial applications, switchgear and motor generator sets

Tyree Industries Ltd. (controlling interest held by Westinghouse Electric Corporation, U.S.)
Distribution and power transformers

G.E.C. (Australia) Ltd. (subsidiary of General Electric Co. Ltd., U.K.)
Transformers, motor generator sets, switchgear, power circuit breakers, and relays

FPE Australia Ltd. (subsidiary of Brown–Boveri and Company, Switzerland)
Circuit breakers, switchgear, and switchboards

Australia ASEA (subsidiary of ASEA, Sweden)
Minimum oil and air break circuit breakers (up to 132 kV), distribution and power transformers, and LV switchgear

International Combustion Australia Ltd. (partially owned by International Combustion U.K., and Combustion Engineering Inc., licensee of International Combustion, U.K.)
Power boilers (including water tube boilers fired by oil, gas, coal, or other fuels)

State Dockyard
Condensing and feedwater heating plant

Dunlite Manufacturers, Ltd. (subsidiary of Pye Industries, Ltd., U.K.)
Motor generator sets, DC motors, and power packs

Petbow Pty Ltd. (subsidiary of Petbow Ltd., U.K.)
Alternators and motor generator sets

Detroit Engineering and Tool Company (representative of General Motors)
Standby diesel motor generator sets

Wilson Electric Transformer Co. Pty Ltd. (partially owned by Ferranti Ltd., U.K.)
Distribution and power transformers

Stangar & Company Ltd.
Switchgear (including HV and LV airbreak switches) fuses, fusegear, isolated phase busbars, insulators, switchboard accessories, current transformers, minimum oil circuit breakers, and HV power systems

Switchgear Pty Ltd.
Transmission and distribution switchgear, insulators, and substation equipment

Oliver J. Nilsen Australia Ltd. (licensee of AEG Telefunken, Germany, for contractors and of Toshiba, Japan, for switchgear)
Switchgear, contactors, circuit breakers, transformers, insulators, relays, control equipment, switchboards, transmission line equipment, and electric motors

United States manufacturers

Westinghouse Electric Corporation
Gas and steam turbines, computer and related generator control equipment, electrical switchgear, and LV knockdown circuit breakers

General Electric Company, United States
Automation and control systems, hydraulic machine winding equipment, land and marine gas turbines, steam turbines, and electrical components

I.T.E. Imperial Corporation [1]
Switchgear, power circuit breakers, and HV circuit breakers

Caterpillar Tractor Co.
Diesel motor generator sets

Square D Company
Fuse switchgear, circuit breakers, control circuit relays, and control gear

Texas Instruments Incorporated
Motor protectors, relays, and circuit breakers

General Motors Corporation
Diesel motors

RTE Corporation
Transformer components, oil-type switches, and fuse gear

Cutler-Hammer International[1]
Contactors, starters, medium-voltage switchgear, and control gear

Heinemann Electric Company [1]
Circuit breakers

Third-country manufacturers

General Electric Company Limited (G.E.C.) (United Kingdom)
Large steam turbine generator sets, steam and gas turbine generators, water wheel generators, power circuit breakers, control circuit relays, transformers, and switchgear

Reyolle Parsons Ltd.[1] (United Kingdom)
Steam turbine generator sets and power circuit breakers

Hawker Siddeley Group Limited [1] (United Kingdom)
Diesel motor generator sets and mobile gas turbine sets

Siemens A. G. (Germany)
Steam and gas turibne generator sets, water wheel generators, and both HV and LV power circuit breakers

Klocker Moreller Pty Ltd. (Germany)
Power circuit breakers and control equipment

Sprecher and Schuh (Switzerland)
Switchgear, power circuit breakers, and relays

Brown–Boveri and Company (Switzerland)
Gas turbine generator sets and power circuit breakers

Table 2.—Australia: Major suppliers of electric power equipment—continued

Toshiba (Japan, licensee of General Electric)
Steam turbine generator sets and large power transformers

Mitsubishi (Japan)
Water wheel generators and steam turbine generator sets

Allmanna Svenska Elektriska AB (ASEA) (Sweden)
AC and DC generators, control equipment, rectifiers, steam turbines, relays, power regulators, switchgear, circuit breakers, and transformers

C.E.S.O. International Limited (Canada)
Power boilers and steam generating plant

[1] Firm has Australian subsidiary which is not included in the above list of domestic suppliers.

Source: Bureau of International Commerce, Office of International Marketing research study.

mobile diesel motor (150- to 1,000-kW) generator sets. Also likely to offer good sales potential are SF6 and vacuum circuit breakers, oil-filled pressure cables, piped-type cables, power plant instrumentation, and computer control systems.

Third-country suppliers in aggregate provide 85-90% of imports to Australia. European and Japanese companies are important competitors in sales of generation as well as transmission and distribution equipment. British firms have long enjoyed an established position in this market, but in recent years Japanese, German, Swiss, and other European manufacturers have made inroads in the British market share.

The similarity of Australian and U.K. electrical standards has given British suppliers a special advantage in the power equipment market; they have also established their position through competitive prices and the technical quality of their products. British firms provided over 42% of power equipment imports in 1974 and are expected to maintain at least a 36% share through the remainder of the decade. They supplied a substantial portion of the large steam turbine generator sets used in the utility sector as well as a wide range of smaller steam and gas generator sets and diesel motor generator sets to utility and industrial users. British-made circuit breakers (especially HV metal-clad types), switchgear, fuse switches, and control circuit relays are popular in the Australian market and generally are competitively priced.

Table 3.—Australia: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in millions of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	7.9	6.4	12
United Kingdom	23.3	24.7	30
Japan	12.5	9.1	19
Germany	3.2	6.8	11
Switzerland	.7	.5	1
All others	7.8	3.8	4
Total	55.4	51.3	77
Transmission and distribution equipment			
United States	2.4	2.1	3
United Kingdom	6.3	5.4	7
Germany	2.8	2.9	3
Switzerland	1.9	2.3	4
Japan	1.3	1.4	2
All others	4.0	5.9	6
Total	18.7	20.0	25
Total			
United States	10.3	8.5	15
United Kingdom	29.6	20.1	37
Japan	13.8	10.5	21
Germany	6.0	9.7	14
Switzerland	2.6	2.8	5
All others	11.8	9.7	10
Grand Total	74.1	71.3	102

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Australian statistics and trade source estimates.

In recent years, Japanese firms have bid successfully on several large utility contracts. They have supplied large steam turbine generator sets, and their equipment is highly regarded for quality, design, and workmanship. These suppliers have also registered significant sales of water wheel generators to the Snowy Mountain Authority and smaller steam turbine generator sets for industrial applications. Their share of generation equipment imports is expected to approach 25% (some $19 million) in 1979. The Japanese, less active in selling transmission and distribution equipment, have mainly provided large power transformers to electric utilities, with annual sales running less than $2 million.

Several German suppliers compete in this market, and are expected to furnish about 14% of Australia's power equipment imports in the 1974-79 period. German-origin hydroelectric generation equipment, steam and gas generator sets, and water wheel generators enjoy a reputation for high quality and performance. German-made circuit breakers and fuse switchgear are used extensively because of their design and reliability.

Swiss suppliers are highly regarded for the advanced design and superior quailty of their transmission and distribution equipment. They provided 11% of these imports in 1974 and are expected to secure a 16% share by 1979. Circuit breakers (mainly HV metal-clad indoor types filled with SF6, highly compressed air, or oil), switchgear, relays, and frequency injection equipment are the principal imports from Switzerland.

Other competitors include Swedish, Canadian, French, Italian, and Dutch firms. Many of these manufacturers enjoy established reputations for their product lines and hold small, yet important, market shares.

Trade and technical regulations.—Imports of electrical power equipment are generally subject to customs duties ranging from 6 to 34%, but some items, notably gas turbines and lightning arrestors, enter free of duty. Preferential rates, ranging between 6 and 28%, and wider duty-free status apply to imports from the United Kingdom, Canada, and New Zealand.

In addition, two Australian states require preferential treatment for local manufacturers in bidding for electric utility and other public contracts. In Queensland a 5% preference is applied to equipment manufactured within the State. The Government of New South Wales (NSW) grants a preference to Australian manufacturers (ranging from 10 to 30%, depending on origin) and to British equipment (usually 10%) over other sources of imports.

Imported electrical power equipment must confirm to the standards established by the Australian Standards Association. Equipment to be used in the utility sector must also conform to the electrical specifications established by the utilities.[2] Information on the availability of published standards in Australia may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Trade practices.—Industrial users generally obtain engineering assistance for designing, specifying, purchasing, managing, and installing electrical energy systems. Several large British and American engineering firms have participated in industrial power projects in recent years. Trade sources estimate the purchases of electrical power equipment by consulting and contracting engineers at about $26 million in 1974.

Australian utilities are closely involved in drafting specifications for their electrical power equipment and systems consequently, they; rarely use the services of consulting and contracting engineers in purchasing equipment. However, they do frequently employ major international contracting firms for assistance on large power projects. Most utilities have large engineering staffs, and they purchase equipment such as turbine generator sets on a modified turnkey basis whereby the supplier is required to manufacture, deliver, and install the turbine and remain the principal contractor for condensing and feed heating plant.

Domestic production.—Australian production of generation, transmission, and distribution equipment for the domestic market approached $211 million in 1974 and is forecast at $240 million in 1979. Most types of generating equipment (except turbines and turbine generator sets) are manufactured in Australia, and domestic firms produce a wide range of transmission and distribution equipment. Production of generating equipment was valued at almost $143 million in 1974 and is forecast to expand to $160 million by 1979, while domestic production of transmission and distribution equipment is expected to reach $80 million by 1979. Exports are conducted on a limited scale and consist mainly of transformers and switchgear.

Domestic production of power boilers totaled almost $96 mililon in 1974. Four large contractors account for most domestic supply: Babcock and Wilcox Ltd., Riley Dodds Australia Ltd., International Combustion Australia Ltd. (ICAL), and John Thompson Pty Ltd. These firms are all capable of providing complete steam generating installations with equipment of their own manufacture or obtained from specialized subcontratcors. ICAL has the most extensive manufacturing facilities, and trade sources estimate it serves almost a third of the total power boiler market, while the other three contractors each hold 15 to 20%. Some 15 manufacturers produce "packaged" boilers, boiler parts, and auxiliary equipment, including economizers, superheaters, condensers, and feedwater heating plant. The government-owned State Dockyard is the leading manufacturer of condensing and feedwater heating plants.

Trade sources estimate local production of motor generator sets in 1975 at nearly $8 million; 9 manufacturers make complete sets, and at least 18 companies provide electric motors. The capacity of most locally manufactured motor generators is 500 kVA. Foreign-owned or -licensed firms predominate in this field. Expanding demand for mobile and portable motor generators assures domestic manufacturers of good growth prospects over the remainder of the decade.

Transformers have been manufactured in Australia for more than 50 years, and domestic production accounts for about 90% of the market. In 1973, power and distribution transformers were manufactured by 10 companies operating a total of 18 factories; their output was valued at over $40 million. The leading domestic firms all have international licensing agreements. The largest manufacturer is Tyree Industries, which serves about a third of the market and exports (over $2 million in 1975) to Asia and the Pacific; it produces a complete range of transformers, from 5 kVA single-phase to 800 MVA 3-phase and voltages up to 750 kV. Growth prospects for domestic producers of above ground distribution transformers have been

[2] The electrical power supply characteristics in most of Australia are 240/415 volts, 50 hertz, 3-phase. The bulk of electricity is supplied as AC with some isolated pockets of DC supply. The metric system of weights and measures is the statutory standard.

dampened slightly by trends toward more underground distribution in residential areas. However, sales of power transformers are expected to maintain steady growth over the remainder of the decade.

Switchgear is manufactured by about 25 firms in Australia; the value of domestic production in 1975 was estimated at over $11 million. Most manufacturers are small-scale establishments producing a wide range of products. The major suppliers are Stangar and Company Ltd. and Switchgear Pty Ltd.; both firms export part of their production.

Circuit breakers are manufactured by several switchgear suppliers, as well as by the local subsidiaries and licensees of major British, American, Swiss, and Swedish suppliers.

Customs duties, preferential treatment in bids for utility contracts, and market proximity are factors which contribute to a price advantage enjoyed by domestic manufacturers. Other advantages which domestic manufacturers have over their foreign competitors are shorter delivery lead time, flexibility for customized service, and accessibility for spare parts and aftersales service.

Domestic power equipment manufacturers constitute a significant market for imported components and instrumentation (see End-User section on Original Equipment Manufacturers).

End Users

Electric utilities.—The Australian electric utility industry plans to continue expanding generating capacity and to proceed with modernization of transmission and distribution equipment and systems. An additional 12,000 MW will be added by 1985 to the present (1976) generating capacity of 20,988 MW. Capital expenditures for the industry, which exceeded $610 million in 1974, are forecast to surpass $1 billion in 1980 (see table 4).

Most of Australia's electrical energy is generated by conventional coal-fired steam methods: the utilities are expected to continue relying on this technology over the next few decades because of Australia's abundant coal resources. Hydroelectric capacity has been augmented in recent years. Completion of the Snowy Mountains Hydro-Electric Scheme in 1975 added 3,740 MW to generating capacity. This project, which includes 16 major dams and 7 large power stations, involved expenditures in excess of $1 billion and required 15 years for completion. In Tasmania, the state utility has another 1,202 MW of hydroplant installed. Other forms of power generation are used by the utilities on a much smaller scale (see figure 2).

Investment in generation, transmission and distribution equipment is forecast to increase substantially in the 1975-79 period. New equipment purchases are expected to reach $277 million in 1979 (see table 5).

Power boilers, the largest item represented in utility expenditures, typically account for about

Table 4.—Australia: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in millions of U.S. dollars)[1]

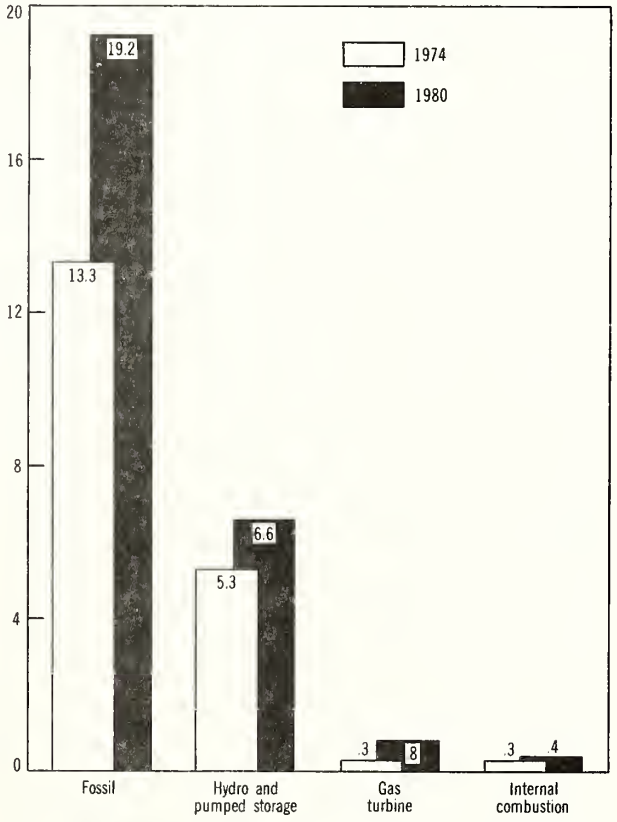
	1973	1974	1980
Generation			
Fossil	182.7	222.0	452
Hydro	43.5	61.3	57
Pumped storage	7.1	7.5	8
Gas turbine	8.5	10.4	25
Internal combustion	4.2	7.5	9
Total	246.0	308.7	551
Transmission	74.8	76.7	136
Distribution	169.5	190.7	286
Miscellaneous	31.1	34.3	67
Total	521.4	610.4	1,040

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Australian statistics and trade source estimates.

Figure 2.—Australia: Electric utility generating capacity, 1974 and projected 1980

(in gigawatts)



Source: Bureau of International Commerce, Office of International Marketing research study; values based on official Australian statistics and trade source estimates.

Table 5.—Australia: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	68.4	83.6	97.6	89.7	116
Turbine generator sets					
Steam	29.2	38.3	38.0	39.3	54
Gas	2.5	4.8	5.8	5.8	7
Hydraulic	7.4	12.0	12.7	9.8	11
Motor generator sets					
Diesel	2.7	4.4	5.0	4.8	7
Gasoline	.1	.1	.1	.1	[2]
Total	110.3	143.2	159.2	149.5	195
Transmission and distribution equipment					
Distribution transformers	11.0	10.6	11.0	10.3	13
Small power transformers	8.7	7.1	8.2	7.9	10
Large power transformers	13.7	14.7	15.0	14.4	18
Power regulators and boosters	2.1	2.7	3.1	2.8	4
Switchgear	8.5	10.6	11.9	10.7	14
Power circuit breakers	9.6	12.2	13.9	13.0	16
Control circuit relays	3.3	4.8	5.8	5.4	7
Total	56.9	62.7	68.9	64.5	82
Grand Total	167.2	205.9	228.1	214.0	277

[1] For exchange rates, see table 1.

[2] Projected to reach $131,000 by 1979.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Australian statistics and trade source estimates.

40% of total spending. Because of power plant construction underway in several states, exceptionally large purchases of power boilers were recorded in 1973 and 1974 ($83.6 million and $97.6 million, respectively). Demand declined slightly in 1975 and is expected to remain stable through 1976 and possibly 1977, with trade sources anticipating a major surge upward in 1979 as work begins on two major projects in Victoria and NSW. The utilities in NSW and Victoria normally provide a steady demand for this equipment, while purchases by other utilities are less regular. The new plants to be started in the late 1970's, among the largest planned in recent years, will offer exceptional sales opportunities for power boiler suppliers. Purchases of this equipment are expected to reach $116 million in 1979.

The utilities will also be making major purchases of steam turbine generator sets for new power plants; expenditures for this equipment are forecast at $54 million in 1979. The trend in recent projects has been toward larger unit sizes, with two 660-MW units planned for the Vales Point (NSW) power station (slated for completion in 1979). Other large purchases anticipated during the late 1970's will include four 500-MW units for the Loy Yang station (Victoria).

Demand is growing for mobile and peak topping gas turbine generator sets. Most of the larger utilities intend to purchase either 30-MW or 60-MW mobile sets.

Completion of the Snowy Mountain project brought a decline in demand for hydraulic generator sets during 1975. However, with expansion of hydroelectric capacity in Tasmania and construction of new pumped-storage facilities in NSW, new sales opportunities for this equipment will develop in the utility sector in 1976-79.

Utilities are expected to boost their purchases of diesel motor generator sets from $5 million in 1974 to about $7 million in 1979. These sets, which are used mainly by distributors of electricity and by utilities located in remote areas, also serve as emergency and standby equipment in many urban locations.

Manufacturers of large power transformers should find exceptional markets in the utilities during the late 1970's, with sales forecast to reach $18 million in 1979. Demand for this equipment will increase with the installation of new power stations, additional switching stations, and the movement to indoor switching and substations. The potential for sales will also be augmented by plans to boost the transmission systems in various states to match load growth. Trade sources anticipate a trend in these purchases toward larger unit sizes.

Switchgear will be required in even larger quantities by the utilities; expenditures for this equipment are expected to increase from $10.7 million in 1975 to $14 million in 1979. The items likely to be in greatest demand include contractors, isolators, and fuses. Purchases of power circuit breakers are forecast to increase from $13 million in 1975 to $16 million in 1979. Environmental concern has prompted a recent trend to both high- and low-voltage, metal-clad circuit breakers using SF6 for outdoor and indoor usage.

Each Australian state has its own pattern of electrical power supply and distribution. Within each of the six states there is one major electric utility that is responsible to its respective State Government; it controls power generation and transmission facilities and either transfers bulk electricity to distribution authorities (generally county or municipal councils) or supplies customers directly (see table 6). The two largest utilities are the Electricity Commission of New South Wales (installed generating capacity of 6,494 MW in 1975) and the State Electricity Commission (SEC) of Victoria (4,526 MW). The NSW Commission operates a number of interconnected power stations and transmits electricity for sale in bulk to some 41 distribution authorities (mainly local government councils, municipal and shire councils, as well as some private franchise holders). In addition to the public supply, a number of industries in NSW generate all or part of their energy requirements.

Table 6.—Australia: Composition of electric utilities by ownership

	Number of utilities	Percent of total generating capacity
Private	5	2
Federal [1]	4	17
Municipal [2]	127	11
State	6	70
Total	142	100

[1] The bulk of federal capacity is hydroelectric, which is distributed to the States.

[2] Reorganization during 1976 in the State of Queensland will place most of the generating capacity held by municipal utilities under control of State Governments, reducing overall municipal capacity from 11% to about 2% of country total.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Australian statistics and trade source estimates.

Although the utilities have explored the use of nuclear energy for generating electricity, they are not likely to introduce nuclear power stations before the late 1980's. It is generally conceded that it takes at least 12 years to plan and construct a nuclear plant, and only two states (Victoria and Western Australia) have shown any inclination to begin such planning. In addition, many safety and environmental regulations still have to be clarified before the public accepts the use of nuclear reactors. Although Australia has assured uranium reserves for fueling reactors and is considering the establishment of a nuclear enrichment plant, domestic manufacturers are not yet capable of supplying nuclear reactors. Consequently, a move to nuclear power would require importing most of the nuclear energy system. The engineering staffs of the utilities are well informed on nuclear power developments, and trade sources report that U.S.-designed pressure water nuclear reactors are highly regarded in these circles.

The State Electricity Commission (SEC) in Victoria is Australia's largest single electric power supplier, with 18,500 employees. The SEC serves about 80% (some 1.15 million) of its customers directly and the other 20% through 11 municipalities in Melbourne. Queensland has the most decentralized system, with 22 electric supply authorities. The other utility authorities are Tasmania's Hydro-Electric Commission, responsible for generation, distribution, and retail sale of electricity from hydro and other sources in the State; the State Energy Commission of Western Australia, which provides 98% of that state's supply from five thermal generating stations; and the Electricity Trust of South Australia with a capacity of 1,185 MW, which supplies 99% of that state's requirements.

The Federal Government, which provides about 17% of the total generating capacity, also buys generation, transmission and distribution equipment. The Government is responsible for power generation and distribution in the Australian Capital Territory (ACT), the Northern Territory, and the Snowy Mountains project. Investment in this sector is forecast to increase steadily in the 1975-79 period, from $13.5 million in 1975 to $18 million in 1979. Expenditures for generating equipment, $8.4 million in 1975, are expected to reach $10.5 million in 1979, with mobile motor and gas turbine generator sets the chief items. During the next 5 years, two steam turbine generator sets will be purchased for Darwin and diesel sets will be obtained for Alive Springs and Katerine, all located in the Northern Territory. Purchases of transmission and distribution equipment are forecast to increase from $5 million in 1975 to $7 million by 1979, with repair of cyclone damage in Darwin and provision of underground distribution accounting for most of these expenditures; also contributing will be additional distribution facilities for new housing developments in the ACT.

Although the utilities have explored the use of nuclear energy for generating electricity, they are not likely to introduce nuclear power stations before the late 1980's. It is generally conceded that it takes at least 12 years to plan and construct a nuclear plant, and only two states (Victoria and Western Australia) have shown any inclination to begin such planning. In addition, many safety and environmental regulations still have to be clarified before the public accepts the use of nuclear reactors. Although Australia has assured uranium reserves for fueling reactors and is considering the establishment of a nuclear enrichment plant, domestic manufacturers are not yet capable of supplying nuclear reactors. Consequently, a move to nuclear power would require importing most of the nuclear energy system. The engineering staffs of the utilities are well informed on nuclear power developments, and trade sources report that U.S.-designed pressure water nuclear reactors are highly regarded in these circles.

Most new power plants scheduled to begin operations during the next 5 years will incorporate fossil-fuel steam-generating units; 25 new units will be added in 1975-80, increasing generating capacity by 9,290 MW at a cost in excess of $2.6 billion (see table 7). Pumped-storage capacity will also be augmented significantly over this period. The two large power plant projects scheduled to begin in 1977 are Loy Yang in Victoria (cost estimated at $714 million) and Eraring in NSW (costing some $380 million); both of these will be fossil fuel (coal) generating plants. Capacity will be 2,000 MW at Loy Yang, and 1,320 MW at Eraring. These two projects will account for the bulk of the utility sector's purchases in the late 1970's.

Industrial end users.—Industrial spending for

Table 7.—Australia: Current and planned construction/ expansion of electric power plants, 1975-80 [1]

Type	Number of units added	Total generating capacity added (MW)	Total cost [2]
Fossil	25	9,290	2,690.5
Hydro	6	568	347.7
Pumped storage	9	1,240	163.8
Gas turbine	4	200	28.8

[1] A detailed breakdown of individual construction projects giving such information as names of contracting engineers, starting and expected completion dates, costs, etc., can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] Value in millions of U.S. dollars. For exchange rate, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Australian statistics and trade source estimates.

electrical power equipment totaled $35.6 million in 1975 and accounted for 13.5% of the market. These expenditures had increased about 12% a year in the 1972-74 period; however, they declined slightly during 1975 as many important industrial end users temporarily limited capital expenditures. Growth is forecast to resume during the remainder of the decade, with spending for generation, transmission and distribution equipment expected to reach $47 million in 1979.

Industrial users, mainly in mining, smelting, and steel making, purchased generation equipment valued at $23.4 million in 1975. Substantial increases in this spending are expected to accompany economic recovery, with industrial demand forecast to reach $31 million by 1979. Power boilers, steam and gas turbines, and diesel motor sets have the highest sales potential. Strikes by utility workers have prompted growing demand in industry for mobile motor generator sets; trade sources forecast that sales of this equipment will increase about 10% a year over the 1975-80 period. The industrial market for diesel motor sets was estimated at about $6.5 million in 1975.

The end-user sectors likely to offer the best sales prospects for U.S. suppliers of motor generator sets include mining, pipelines and construction, as well as shopping centers and high-rise buildings. New markets for gas turbine generator sets in industry are expected to accompany further development of natural gas resources in the late 1970's, with mining and industrial operations in remote areas heading the list of potential customers.

Industry's purchases of transmission and distribution equipment totaled some $12 million in 1975, slightly below spending levels in the 2 preceding years. Recent unfavorable economic conditions disrupted industrial demand for this equipment, but with recovery these expenditures are forecast to reach $16 million in 1979. Industrial end users provide a significant market for small and large power and distribution transformers as well as switchgear and circuit breakers, with smelting, mining, and metal manufacturing the leading purchasers. Trade sources report that circuit breakers and switchgear offer the best sales opportunities for U.S. suppliers.

Original equipment manufacturers.—Domestic equipment manufacturers purchased components valued at more than $51 million in 1975; these expenditures are forecast to exceed $65 million in 1979. Components for generating equipment were valued at $45.8 million in 1975 and are anticipated to be almost $59 million in 1979; parts for power boilers and motor generator sets make up the bulk of these purchases. Australian power boiler manufacturers currently use imported economizers, sootblowers, boiler drums, tubing, valves, and instrumentation, and trade sources anticipate growing demand for imported pressure gages, meters, testing equipment, computer control equipment, and other types of instrumentation. In addition, imported motors, both electric and diesel, are attached to many locally produced generators to make complete units.

Additional Information

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Country Marketing Manager—Australia
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The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Australia." DIB 76-01-502, July 1975.

Purchases of components for transmission and distribution equipment were valued at $5.9 million in 1972, with $6.8 million anticipated by 1979. Local transformer manufacturers are the main purchasers; they use imported load tap changers, porcelain bushings, and electrical sheet steel. Imports also include operating mechanisms for circuit breaker bushings and other types of circuit breaker and switching componentry.

New Technology

Australia is well endowed with energy sources; its coal supply is sufficient to continue reliance on fossil fuel in power generation for several more decades without significant depletion of reserves, and it has uranium for development of nuclear technology. Hydro and natural gas resources also offer further potential as energy sources. The electrical power industry, however, has become aware of growing environmental concern over energy sources and power-generating technologies, and additional alternatives are being explored by the utilities as well as by the research and scientific community.

The potential applications of solar energy are being investigated by the Solar Energy Studies Unit of the Commonwealth Scientific and Industrial Research Organization and by the Australian Academy of Science. For the present, solar technology is considered too costly for use in commercial production of electric power in Australia. Meanwhile, over 10,000 solar water heaters, operating at temperatures up to 55°C, are used in households. Research is continuing on utilization of solar energy for space heating and cooling and as a water heating source for food processing (which requires temperatures up to 95°C).

Computers for controlling generation plants are being used in Australia; the Munmorah thermal station has two digital computer systems, each controlling two 350 MW units, which monitor operations efficiency and safety.

In the area of energy transmission, Australia has already entered the age of Extra High Voltage—400 kilometers of 500 kV line have been installed in the State of Victoria—and will see construction of a 800 kV Ultra High Voltage transmission system in New South Wales by 1980. Underground transmission is also being used, particularly in inner cities.

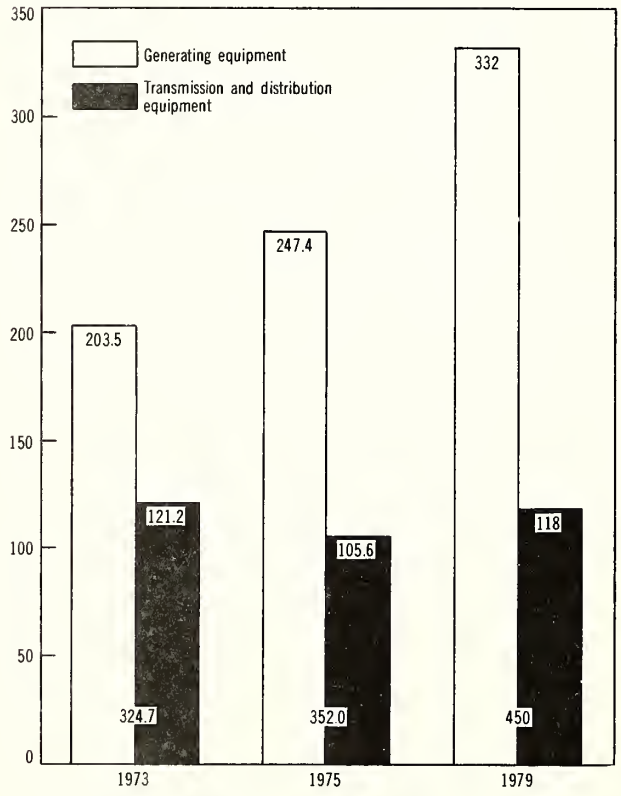
Electrical Energy Systems
Belgium

A heavy influx of foreign companies has signaled the emergence of Belgium as the new administrative and business center of Europe. To meet the growing domestic and commercial demand for electricity, government and industry spent $353 million for generation, transmission, and distribution equipment in 1975, a 5% increase over 1972 purchases; expenditures are projected to rise to $450 million by 1979 (see table 1).

Generation equipment accounted for nearly two-thirds of the electrical energy equipment purchased during the 1972-75 period. Substantial investment in nuclear plant construction is forecast to increase the share of generation equipment sales to nearly 75% of the power equipment market in 1979, while expenditures for transmission and distribution hardware will remain stable at around $120 million a year (see figure 1).

Figure 1.—Belgium: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Federation Professionelle des Producteurs et Distributeurs d'Electricite de Belgique, and Bureau of International Commerce, Office of International Marketing research study.

Belgium boasts a well-established engineering establishment which wins almost all the national utilities' design and consultants contracts. American engineers have found the majority of their work in Belgium in the petrochemical field, where U.S. interests are very strong.

Competitive Environment

Belgium is too small a market to support the manufacture of a complete range of electrical power equipment; therefore, both heavy power equipment, systems and small accessory items required in high volume must be imported. As European nations integrate and merge their industries, manufacturing in Belgium is expected to further decline; many former manufacturers have already become panel builders using imported components. Those companies which have survived usually have strong ties with foreign producers (see table 2).

Imports.—Imports of electrical energy equipment were $33 million in 1974, up only $0.5 million from 1972. Trade sources predict imports will total $40 million in 1979 (see table 3). Transmission and distribution equipment accounted for 72% of these imports in 1974, or $23.6 million, and are projected to reach $26 million in 1979.

U.S. firms supplied 9% to 10% of the generation equipment imported in 1973-74. This low ratio

Table 1.—Belgium: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	200.0	175.0	190.0	220.0	300
Transmission and distribution equipment	90.0	105.0	110.0	90.0	100
Total	290.0	280.0	300.0	310.0	400
Industrial companies					
Generation equipment	25.0	24.0	23.0	22.0	25
Transmission and distribution equipment	15.0	14.0	13.0	13.0	15
Total	40.0	38.0	36.0	35.0	40
Government (other than utilities)					
Generation equipment	4.0	4.5	5.0	5.4	7
Transmission and distribution equipment	2.0	2.2	2.5	2.6	3
Total	6.0	6.7	7.5	8.0	10
Grand total	336.0	325.7	343.5	353.0	450

[1] All figures converted at the following rates: 1972— US$1=BF 44.01; 1973—US$1=BF 38.98; 1974 and thereafter—US$1=BF 38.80.
Source: Federation Professionelle des Producteurs et Distributeurs d'Electricite de Belgique and Bureau of International Commerce, Office of International Marketing research study.

was due in part to the higher prices of American-made goods, but the rapid rise in labor costs throughout Europe has eliminated this disadvantage. Belgian reliance on nuclear power for the future will benefit American producers of nuclear power equipment, and trade sources expect U.S. firms to hold almost 15% of the generation equipment import market by 1979. End users have also shown particular interest in American diesel sets, gas turbines, switchgear, transformers, cables, and advanced electronic instrumentation.

A large industrial park is being developed in the vicinity of Brussels Airport and many U.S. companies are setting up factories there. A list of these potential customers for U.S. electrical energy equipment can be obtained from the American Chamber of Commerce in Belgium, rue du Commerce 21, B-1040, Brussels.

German and French companies supply about two-thirds of the electric power equipment in Belgium. Their major products include turbines, transformers, switchgear above 70 kilovolts (kv), and portable or mobile generators. Most of the large manufacturers sell through their Belgian subsidiaries.

British manufacturers have captured about 10% of generation equipment imports but have made few sales of transmission and distribution equipment. Although companies from Japan and the East European bloc countries quote lower prices and longer credit terms than their competitors in the European power station equipment market, Belgian engineers have been reluctant to recommend them.

Trade and Technical Regulations.—Import duties on American-made electrical power equipment range from 5% to 10%, which gives some advantage to domestic and Common Market manufacturers who are not subject to such tariffs. No other assessments are made. Technical standards are imposed by the Comite Electrotechnique Belge and tend to follow International Electrotechnical Commission standards.[1]

Trade practices.—Virtually all major purchasing decisions in the electrical power field are influenced by two consulting engineering firms—Societe de Traction et d'Electricite (Tractionel) and Electrobel. These companies design all of Belgium's public utility power generation and distribution facilities and play a crucial role in specifying the types of equipment used. Tractionel owns shares in Electrobel, and both consultants own large shares in the utility companies, their oil suppliers, their customers, and electrical plant manufacturers. These consulting firms have excellent reputations and extend their activities into third-world countries.

Domestic production.—Ateliers de Construction Electriques de Charleroi S.A. (ACEC) is the principal manufacurer of all major electrical power equipment, except switchgear. Until 1970 ACEC supplied generating units for all of Belgium's power stations although in some cases those above 1,000 megavolt amperes (MVA) were imported from the United States for local assembly. The company holds 73% of the Belgian generator transformer market and provides 80% of both systems and special transformers.

ACEC makes some switchgear, but nothing above 36 kV, and its magnetic units in the 1-kV to 36-kV range are not highly competitive. Therefore, much of the firm's switchgear sales are to its industrial turnkey projects that include these products.

The leading domestic producer of switchgear, Electricite Industrielle Belge (EIB), makes nothing for service over 70 kV. EIB has not kept up-to-date in its production and management techniques, and as a result has felt increasing competition from German and French manufacturers. Another important switchgear maker, N. V. Gardy, has also faced increasing competition because of obsolete production processes.

Cockerill, the large steelworks, is the principal supplier of boilers and is an important subcontractor for nuclear power stations. Pauwels Trafo N/V has become one of the world's most important manufacturers of distribution transformers, which it

[1] Electrical power is supplied at 380 V, 3-phase, 50 Hz, with the equivalent single-phase voltage of 220. The metric system of weights and measures is standard. Information on the availability of published standards in Belgium may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Table 2.—Belgium: Major suppliers of electrical power equipment

Domestic manufacturers

Ateliers de Constructions Electriques de Charleroi (AEC) (67% of shares held by Westinghouse, U.S.)
Motors, alternators, transformers, switchgear

Electricite Industrielle Belge (EIB)
Switchgear

N.V. Gardy (affiliate of Gardy, Austria)
Switchgear

AEG-Telefunken, S.A. (subsidiary of AEG, Germnay)
Motors

Societe Belge des Ateliers de Delle, S.A. (subsidiary of Delle, France)
Switchgear

S.A. Cockerill-Ovgree-Providence et Esperance-Longdoz
Power boilers, nuclear reactors

Pauwels Trafo N/V
Transformers

Cablerie de Charleroi (subsidiary of CEAT, Italy)
Cables

Cableries et Corderies du Hainaut
Cables

Vynckier Freres (subsidiary of GEC, United Kingdom)
Load switches, plastic boxes for control gear

United States manufacturers

General Electric
Gas turbines

Westinghouse
Nuclear reactor components

Third-country manufacturers

Siemens (Germany)
Switchgear, generators, motors

Leroy (France)
Motors

GEC (United Kingdom)
Motors, transformers

ASEA (Sweden)
Motors, switchgear

Heemaf (Netherlands)
Motors

Jeumont-Schneider (France)
Transformers, motors

Unelec (France)
Motors, transformers

Brown-Boveri & Cie (Switzerland)
Motors, transformers, switchgear

CEM (France)
Transformers

Italtrafo (Italy)
Transformers

Lepper-Dominit (Germany)
Transformers

Le Transformateur (France)
Transformers

Source: Bureau of International Commerce, Office of International Marketing research study.

produces on an assembly line using the folded tank technique.

Vynckier Freres is a highly successful and profitable company that makes plastic products for the electrical industry. Its chief products are load-switches and plastic boxes for control gear. The boxes are sold full of gear in Belgium, but empty (hence not competing with their customers) outside the country.

The successful domestic electrical power equipment manufacturers view Europe as their home market and their local headquarters as their European sales offices. Belgian firms sell enough of the products mentioned above to hold appreciable shares of the markets in France, Germany, and the Netherlands.

In general, the major companies are concerned with developing new products but not with remaining in the forefront of technology. ACEC, for example, has close relations with Westinghouse and is expected to increase its dependence on imported advanced technology and parts when it builds nuclear power stations. Altogether, Belgian electrical power equipment manufacturers spent nearly $18 million for foreign-made instruments, components, and subassemblies in 1975 and are projected to increase these purchases to almost $23 million in 1979.

End Users

Electric utilities.—Before the oil crisis, Belgium's electrical output grew roughly 10% yearly, one of the highest rates in Europe. This growth rate declined to 5% in 1974 and has since remained at this level. Trade sources attribute the slowdown to the decline in heavy industry, particularly steelmaking. Domestic consumption was reduced by higher prices and mild winters, but this segment accounts for a relatively small percentage of the overall load.

Belgium's electrical power companies have oper-

Table 3.—Belgium: Estimated imports of electrical power equipment, 1973, 1974, and 1979 [1]

(in millions of U.S. dollars) [2]

	1973	1974	1979
Generation equipment			
United States	.8	.9	2
Germany	3.3	3.3	5
France	2.6	2.8	4
United Kingdom	1.0	1.0	1
Netherlands	.6	.6	1
All others	.7	.8	1
Subtotal	9.0	9.4	14
Transmission and distribution equipment			
United States	—	—	—
Germany	8.3	8.3	9
France	7.4	7.5	8
Netherlands	2.3	2.3	3
All others	5.5	5.5	6
Subtotal	23.5	23.6	26
Totals			
United States	.8	.9	2
Germany	11.6	11.6	14
France	10.0	10.3	12
Netherlands	2.9	2.9	4
All others	7.2	7.3	8
Grand total	32.5	33.0	40

[1] Includes Luxembourg.

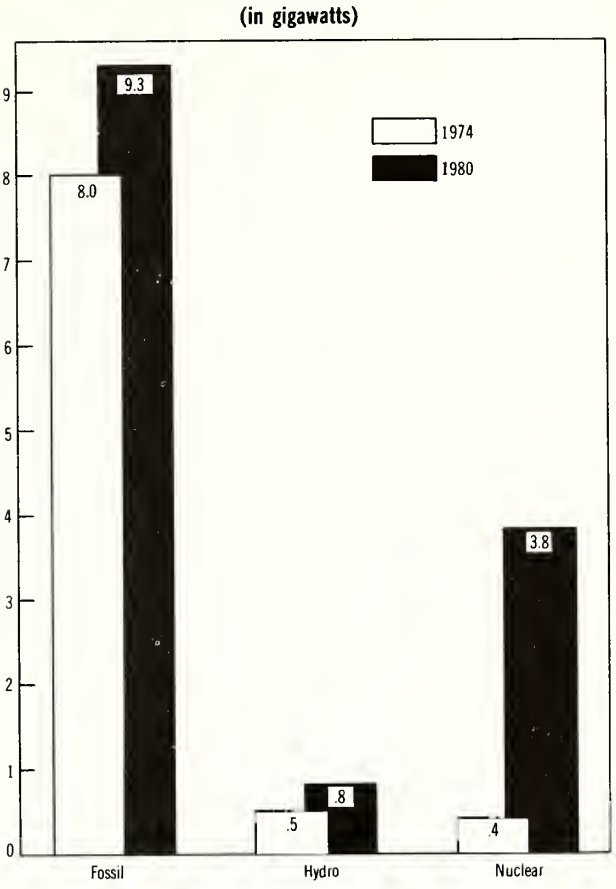
[2] For exchange rates, see table 1.

Source: Bulletin Mensuel du Commerce Exterier and Bureau of International Commerce, Office of International Marketing research study.

ated conventional thermal stations originally designed to burn coal, which was readily available. As the country's coal fields were exhausted, power plants were converted to petroleum. Coal accounted for 75% of the fuel consumed by the utilities in 1960, but by 1968 it provided only half of the fuel required while oil had risen to 38% and gas to just over 10%. Coal use continued to decline rapidly, accounting for only 16% of the fuel suppliers in 1972, while oil supplied 51%, and gas 31%. When petroleum prices suddenly skyrocketed due to the Arab embargo, utilities began to shift away from oil and, by 1975, had reduced its use to 45%. The trend now is toward increased dependence on nuclear energy (see figure 2).

Capital expenditures by the utilities rose from $376 million in 1973 to more than $400 million in 1974 and are projected at $525 million in 1980 (see table 4). More than four-fifths of the funds allocated in 1980 for generation equipment is expected to be spent on nuclear power plants. Power boiler sales are expected to decline as sales of nuclear reactors increase (see table 5). A number of gas turbine installations are also planned. The nuclear construction program will assure that generator and systems transformer purchases will not be reduced.

Figure 2.—Belgium: Electric utility generating capacity, 1974 and projected 1980



Source: Federation Professionelle des Producteurs et Distributeurs d'Electricite de Belgique annual report for 1973 and preliminary report for 1974.

The 11 privately-owned utilities that make up l'Union des Exploitations Electriques en Belgique (UEEB) produce more than 70% of the power generated annually in Belgium (see table 6). However, of those 11 utilities, 4 companies—Societes Reunies d'Energie du Bassin de l'Escaut S.A. (EBES), Societe d'Electricite de Sambre et Meuse, des Ardennes et du Luxembourg S.A. (Esmalux), Union Intercommunale des Centrales Electriques du Brabant S.A. (Interbrabant), and Societe Intercommunable Belge de Gaz et d'Electricite (Intercom)—account for about two-thirds of the nation's electric supply.

UEEB members often build and operate power stations jointly. For example, power from one station is shared by several utilities on the following basis:

EBES	35%
Intercom	33.67%
Interbrabant	19%
Esmalux	3.33%
Others	9%

Table 4.—Belgium: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in millions of U.S. dollars) [1]

	1973	1974	1980
Generation			
Fossil	115	100	25
Nuclear	40	60	250
Hydro	5	5	5
Pumped storage	5	5	5
Gas turbine	5	10	10
Internal combustion	5	5	5
Total	175	185	300
Transmission	61	63	65
Distribution	130	144	150
Miscellaneous	10	10	10
Grand total	376	402	525

[1] For exchange rates, see table 1.

Source: Federation Professionelle des Producteurs et Distributeurs d'Electricite de Belgique annual report and Bureau of International Commerce, Office of International Marketing research study.

The publicly owned utilities operate 11 plants, including 4 in Luxembourg. Seven of their stations are small hydro facilities, and one is an 11.2 megawatt (MW) experimental nuclear station.

Industrial power producers are included in the utility sector in Belgium because only about half their total load is generated for use in industrial processes and production; surplus power is sold to the national grid. These companies generated 26.8% of all the electric power produced in Belgium in 1973. Since 1962 they have spent nothing on low voltage distribution and since 1967 nothing on high tension distribution below 36 kV. Expenditures rose to $4 million for transmission equipment above 36 kV and $18.6 million for generation equipment in 1972.

Table 5.—Belgium: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	60.0	50.0	40.0	30.0	20
Nuclear reactors	10.0	40.0	55.0	80.0	120
Turbine generator sets					
Steam	121.0	73.0	78.0	93.0	143
Gas	2.0	5.0	10.0	10.0	10
Hydraulic	2.0	2.0	2.0	2.0	2
Diesel motor generator sets	5.0	5.0	5.0	5.0	5
Total	200.0	175.0	190.0	220.0	300
Transmission and distribution equipment					
Distribution transformers	24.5	25.2	23.9	20.0	20
Small power transformers	5.0	6.0	6.0	5.0	5
Secondary unit substation transformers	14.0	17.0	18.0	12.5	15
Large power transformers	18.0	23.0	25.0	19.0	20
Switchgear	25.0	30.0	33.0	30.0	35
Power circuit breakers	3.0	3.3	3.5	3.0	4
Control circuit relays	.5	.5	.6	.5	1
Total	90.0	105.0	110.0	90.0	100
Grand total	290.0	280.0	300.0	310.0	400

[1] For exchange rates, see table 1.

Source: Federation Professionelle des Producteurs et Distributeurs d'Electricite de Belgique and Bureau of International Commerce, Office of International Marketing research study.

Table 6.—Belgium: Electric generation by sector, 1973

Utilities	Number of stations	Generating capacity (MW)	Percent of total electricity generated
Private	31	5,441	70.9
Public	11	397	2.3
Industry	88	2,412	26.8

Source: Bureau of International Commerce, Office of International Marketing research study.

About half the power generated by industry is produced by three stations owned chiefly by Kempense Steenkolenmijnen. The other 85 plants are all small with only one set (at a steelworks) over 100 MW. Fifty percent of these power stations have a generating capacity ranging from only 5 MW to 50 MW. Gas turbines, diesel sets around 10 MW, and small steam turbines are also widely used. Some sugar refineries are installing sets with 1 MW to 2 MW capacities.

Belgium entered the nuclear field in 1962 with a prototype nuclear power station of 2.5 MW at Mol. The next venture was a joint agreement with France to build a 266-MW station at Chooz in France and an 870-MW plant at Tihange in Belgium, with cost and power shared equally. The Chooz facility cost about $120 million and the one at Tihange about $197 million.

Doel I, a 393-MW, pressurized water reactor PWR-type nuclear power plant built under Westinghouse license, became operational in 1974. Doel II, of similar type and size, was completed in 1975. Belgium is also participating in the prototype 300 MW Kalkar station, a sodium-cooled plant using a breeder reactor. The station will jointly serve Germany, Belgium, and the Netherlands.

Doel III (900/1,000 MW) is scheduled for completion in 1979-80, and Tihange II of the same size is due in 1981; whether these and the seven other stations planned for 1985 completion will actually be constructed is uncertain (see table 7). These plans were based on a power load that doubled every 7 years, and that growth rate has declined. At this point, Belgian utilities are faced with choosing between the very high capital investment required for nuclear plants and the economic and trade-balance problems of using oil. If carried out, the entire nuclear program is projected to cost some $7.7 billion.

Table 7.—Belgium: Current and planned construction/ expansion of electric power plants, 1975-83 [1]

Type	Number of units	Total generating capacity added (MW)
Nuclear	5	4,860
Fossil steam	3	850
Pumped storage	7	664
Combined cycle	2	250
Gas turbine	7	248
Hydro	2	33
Diesel	2	26

[1] A detailed breakdown of individual construction projects giving such information as names of contracting engineers, starting and expected completion dates, costs, etc., can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Belgian statistics and trade source estimates.

As for developing other fuel sources, one Belgian scheme is to use old coal mine slag heaps which according to some industry specialists might yield the equivalent of 1 million tons of coal annually. Large quantities of natural gas are obtained from Holland and widely used for power stations although this source of supply will be severely curtailed by 1985. No efforts are being made to develop either solar or geothermal energy.

Other End Users.—Most industrial plants that have reason for installing captive generation systems are included in the utility sector discussion; smaller Belgian companies spent $35 million for electrical energy equipment in 1975. Although this sum represented a steady decline from the $40 million invested in 1972, a return to higher levels is projected for 1979.

As in other countries, mobile generators are used by the building and construction industry. However, in Belgium it is normal to have commercially supplied electricity on a construction site in the very early stages of construction, so that mobile plants are less important. A substantial market for engine-driven alternator sets exists in the barge-building sector. Belguim has an extensive canal system and uses barges up to 1,000 tons.

Additional Information

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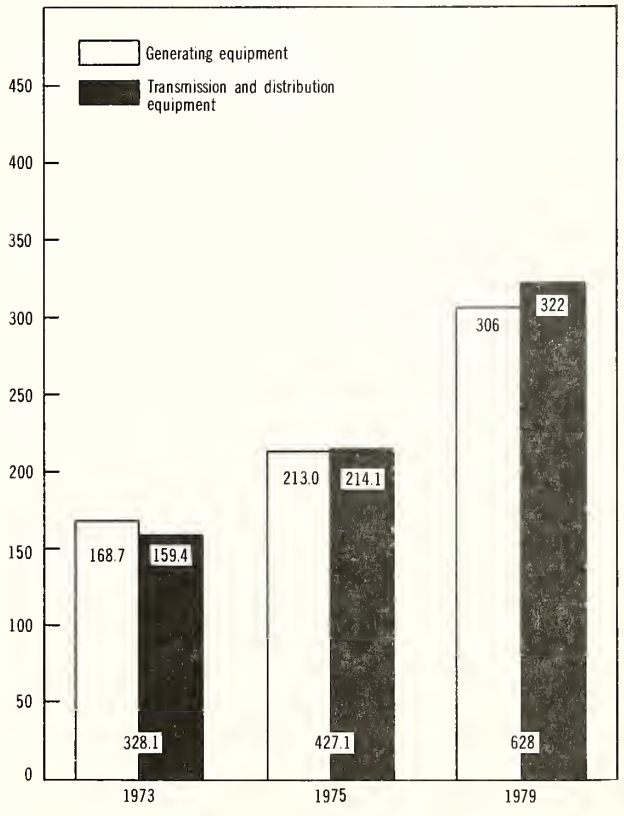
Electrical Energy Systems
Brazil

Spurred by government energy policy, Brazil's total expenditures on generation, transmission, and distribution equipment systems are forecast to increase from an estimated $427 million in 1975 to nearly $630 million in 1979 (see table 1 and figure 1). These expenditures could increase even more rapidly if the utilitities are able to secure liberal financing for these expansion programs.

Electric utilities are expected to increase generating capacity by 70% over the 1974-80 period. Plans emphasize expansion in conventional hydroelectric generation plants, creating a need for turbine generator sets, AC generators, power boilers, and hydroelectric turbines. Construction of extra high voltage (EHV) transmission systems is also anticipated, particularly in areas where generating plants are remote from the consumer regions they service.

Figure 1.—Brazil: Total sales of electrical power equipment, 1973, 1975, and projected 1979 (in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Brazilian Bureau of International Trade and Bureau of International Commerce, Office of International Marketing research study.

The electric utilities sector is expected to purchase about 75% of all generation equipment in 1975-79. The industrial sector should account for about 60% of transmission and distribution equipment over the same period.

Total sales to Brazilian end users of U.S.-manufactured electrical power equipment reached $57.2 million in 1974 and are forecast at $70 million in 1979. Some categories of Brazil's transmission and distribution equipment, such as large power transformers (above 230kV) and control circuit relays, are almost entirely imported.

Competitive Environment

Imports provided about 47% of the electrical power equipment sold in Brazil in 1974. Trade sources expect this proportion to be reduced to 40% by 1979. Firms from the United States have consistently supplied the major share of all categories of imported equipment. Nearly all major domestic suppliers have some type of association (i.e., licensing agreement, joint venture, etc.) with foreign multinational firms, which provide them with high-tension and heavy-duty power plant technology (see table 2).

Imports.—The Brazilian market for imported generation, transmission and distribution equipment

Table 1.—Brazil: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment.	201.8	127.8	39.4	151.8	208
Transmission and distribution equipment.	135.7	66.2	152.8	89.0	127
Total	337.5	194.0	192.2	240.8	335
Industrial companies					
Generation equipment..	48.1	39.8	53.8	61.2	96
Transmission and distribution equipment.	66.6	87.9	105.8	122.4	193
Total	114.7	127.7	159.6	183.6	289
Government (other than utilities)					
Generation equipment.	0.4	1.1	0.3	1.1	2
Transmission and distribution equipment.	1.6	5.3	0.6	1.6	2
Total	2.0	6.4	0.9	2.7	4
Grand Total	454.2	328.1	352.7	427.1	628

[1] All figures converted at the following rates: 1972—US$1 = CR$ 5.934; 1973—US$1 = CR$ 6.126; 1974 and thereafter—US$1 = CR$ 6.790.

Source: Brazilian Bureau of International Trade and Bureau of International Commerce, Office of International Marketing research study.

expanded from $156.7 million in 1973 to $165.3 million in 1974 and is expected to reach $249 million in 1979 (see table 3). Imports of generation equipment are projected to total $103 million in 1979, while transmission and distribution equipment imports are expected to reach $146 million in 1979.

Trade sources anticipate that the total for U.S.-manufactured electrical power equipment imports will increase from $43.2 million in 1973 to $70 million in 1979. The American share in 1979 is projected at about 28% of all imports. The value of Brazil's imports of generation equipment from the United States is expected to more than double in the 1974-79 period, increasing from $11.7 million to $26 million.

The following electric energy equipment from the United States is expected to have excellent sales potential:

- Turbine generator sets, for large hydroelectric plants to be constructed or expanded
- Motor generator sets (especially diesel)
- AC and DC generators
- Circuit breakers (especially those over 100 amperes)
- Sectionalizers
- Control boards
- 3-phase reactors (15 kV and 50 MVA)
- Reactors (138 kV)
- Large power transformers (138 kV and above)
- Control circuit relays

Electrical power equipment imports from third-country suppliers declined from $113.5 million in 1973 to $108.1 million in 1974. However, trade sources predict that by 1979, sales will rise to $179 million.

A recent agreement between Brazil and West Germany provides for the installation of eight German nuclear power plants in Brazil and for extensive imports of German nuclear equipment. German firms are expected to hold about 30% of the generation equipment import market in 1979, up from the 23% which they held in 1974. Their transmission and distribution equipment sales are expected to double, rising from $16.2 million to $36 million in the 1974-79 period. Siemens AG alone accounts for about 25% of the total Brazilian market for electrical energy systems through its various national subsidiaries (including the Brazilian Siemens, S.A.), and is particularly strong in sales of hydrogenerators, sectionalizers, transformers, switchboards, starters, and circuit breakers. Siemens' sales stand a good chance of growing even further in the next few years as a result of the Brazil-West Germany Nuclear Agreement.

Japanese suppliers are expected to increase modestly their share of the total import market from about 10% in 1974 to 11% in 1979; their 1979 sales are projected at $27 million. Trade sources predict that Japan's share of generation equipment imports will fall from 19% to 15% in that period, while that of transmission and distribution equipment will increase from 6% to 8%. Diesel generator sets, distribution generators, and power generators are imported in significant amounts from Japan.

Italian and Swedish firms are expected to continue to supply a significant portion of electrical energy systems in the coming years. Transformers, generators, and hydraulic turbines represent key imports from Italian firms; power transformers, circuit breakers, and lightning arrestors are major Swedish-manufactured imports. Other countries such as France, Canada, Czechoslovakia, Switzerland, and the U.S.S.R. are also expected to continue supplying a measure of Brazil's electric power equipment.

Favorable financing is significant to the future of Brazil's electrical energy systems purchases. Purchases of equipment are made from countries that participate in international institutions such as the International Bank for Reconstruction and Development (World Bank) and the Inter-American Development Bank.

Personal contacts with authorities and engineers responsible for specifications also play a major role in the determination of import sources.

Trade and Technical Regulations.—The import duty, one of several taxes applicable to imports, is

Table 2.—Brazil: Major suppliers of electrical power equipment

Domestic manufacturers

Coemsa Construcoes Electromecanicas S.A. (controlled by multiple Italian firms)
Transformers, voltage regulators, water driven turbines, generators

Confab Industrial S.A.
Nuclear equipment

Eletromar Industria Eletrica Brasileira S.A. (subsidiary of Westinghouse, U.S.)
Circuit breakers, panel boards, starters, safety switches, motor control centers, switchboards

General Electric do Brasil S.A. (subsidiary of General Electric Co., U.S.)
Turbines, generators, transformers, circuit breakers, switchgear, voltage regulators, shunt reactors

Industria Eletrica Brown Boveri, S.A. (subsidiary of Brown Boveri & Cie, Switzerland)
Synchronous generators, turbogenerators, transformers, shunt reactors, complete substations

Ishikawajima do Brasil—Estaleiras S.A. (subsidiary of Ishikawajima Harima Heavy Industries Co., Ltd. Japan)
Diesel generators, boilers, heat exchangers, pressure vessels

M. Dedini S.A. Metalurgica (Brazilian-controlled company, associated with Kawasaki Heavy Industries and C. Itoh & Co., Ltd., Japan)
Heavy boilers, steam turbines, turbogenerators

Mecanica Pesada S.A. (multiple ownership, Brazilian, European, and U.S. firms)
Hydraulic turbines, gates, valves

Siemens S.A. (subsidiary of Siemens A.G., Germany)
Generators, transformers, switchgear, circuit breakers, turbines

Voith S.A.—Maquinas e Equipamentos (subsidiary of J. M. Voith GmbH-Maschinenfabrik, Germany)
Hydraulic turbines, pumps, valves

United States manufacturers

General Electric Co.
Hydrogenerators, transformers, circuit breakers, switches, control boards

Westinghouse Electric Corp.
Switches, circuit breakers, control boards

Harvey Hubbell, Inc.
Starters

Onan Corporation
Generators, generator sets

AMF—Potter & Bromfield
Relays

Southern States Inc.
Sectionalizer keys and fuses

Eaton Corporation
Transmission equipment

Federal Pacific Electric Co.
Circuit breakers

I.T.E. Imperial Corp.
Switchgear, circuit breakers

McGraw-Edison Co.
Voltage regulators, lightning arrestors, oil switches

Third-country manufacturers

Societe Generale de Constructions Electriques et Mecaniques Alsthom (France)
Circuit breakers, steam turbines, pumps, hydraulic turbines

Siemens A.G. (Germany)
Hydrogenerators, sectionalizers, transformers, switchboards, starters, circuit breakers

Brown Boveri & Cie (Switzerland)
Generator sets, circuit breakers, transformers

Allmanna Svenska Elektriska Aktiembologest (Sweden)
Power transformers, circuit breakers, lightning arrestors

Grupo Industrie Eletro Meccaniche per Impiante All'Estero (Italy)
Transformers, generators, hydraulic turbines

Telemecanique Electriques (France)
Protection relays, fuses, parts for panel boards

AEG Telefunken International AG (Germany)
Substation transformers, circuit breakers, control circuit relays, systems for circuit control and protection

Daihatsu Diesel Manufacturing Co. Ltd. (Japan)
Diesel generator sets

Hitachi Ltd. (Japan)
Distribution transformers

Mitsubishi Heavy Industries (Japan)
Power generators, power boilers

Source: U.S. Department of Commerce, Bureau of International Commerce, Office of International Marketing research study.

an ad valorem tax applied to the c.i.f. value of a product, with exemptions made for imported components to be used in assembling goods which are subsequently exported. In 1975, import duties on electric energy systems ranged from 9% on nuclear reactors to 70% on certain types of switches, with most products falling in the 45 to 55% range.

A tax on industrial products is due when goods leave the manufacturing plant or the customs warehouse and is imposed even if a transfer of title is

Table 3.—Brazil: Estimated imports of electrical power equipment, 1973, 1974, and 1979
(in millions of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	14.4	11.7	26
Germany	12.6	10.4	31
Japan	5.3	8.5	15
Sweden	5.7	4.4	9
All others	27.6	10.4	22
Subtotal	65.6	45.4	103
Transmission and distribution equipment			
United States	28.8	45.5	44
Germany	20.2	16.2	36
Sweden	5.0	8.4	9
Japan	8.3	7.4	12
All others	28.8	42.4	45
Subtotal	91.1	119.9	146
Total			
United States	43.2	57.2	70
Germany	32.8	26.6	67
Japan	13.6	15.9	27
Sweden	10.7	12.8	18
All others	56.4	52.8	67
Grand Total	156.7	165.3	249

[1] For exchange rates, see table 1.
Source: Brazilian Bureau of International Trade and Bureau of International Commerce, Office of International Marketing research study.

not involved (as in the case of intracompany transfers). The amount collected can vary from nothing at all to more than 50% of the value of the item, but the rate generally ranges from 5 to 10%. Both the industrial products tax and a state tax, known as the Tax on Circulation of Merchandise (ICM), are calculated on the cost of the item plus the import duty. In the southern, more heavily industrialized regions of Brazil, the ICM rate is 14.5%.

The Brazilian Association for Technical Norms, a private association, establishes standards for the production and use of all industrial equipment. Technical norms are not regulated by law, but conformance to such norms is desirable. Information on Brazilian standards for electrical energy systems may be obtained from: Associacao Brazileira de Normas Technicas, Rua Marques de Itu, 88, Sao Paulo, S.P.—Brazil.[1]

Trade Practices.—Brazilian Government policies foster local industry growth. Tariffs averaging 50% are placed on imports of most electrical energy systems equipment, although such important items as steam turbines and nuclear reactors have much lower rates. The Government offers export incentives in the form of tax reductions, tax credits, and exemption of import duties for components to be used in goods subsequently exported. Brazilian manufacturers can usually obtain loans and long-term credits from the Banco Nacional de Desenvolvimento (the National Economic Development Bank) as incentives for industrial upgrading and expansion. Testing and evaluation services and technological research are offered to Brazilian manufacturers and electric utility companies by the Centro Tecnologico of Eletrobras, a federally controlled company. Several firms have responded to government inducements and have planned substantial investments, but most of the expansion continues to be directed toward low- to medium-voltage electrical equipment.

Domestic production.—The value of Brazil's domestic production of electric energy systems equipment in 1974 was $64.3 million, which included $58.7 million manufactured for national use, and the remaining $5.6 million produced for export. Total domestic production declined 15% in the 1972-74 period.

Approximately 30 key domestic firms, most of which are linked with large multinational corporations, operate in Brazil and produce a wide range of electrical power equipment. Two of the principal domestic firms are General Electric do Brasil S.A. (a subsidiary of the U.S. company) and Siemens S.A. (a subsidiary of the German firm). Both firms manufacture a diversified range of products, encompassing turbines, generators, transformers, circuit breakers, and switchgear. Areas of anticipated growth for the industry are: small power transformers, motor generators, switchgear, AC and DC generators, power circuit breakers, and lightning arrestors.

End Users

Electric utilities.—The generating capacity of the Brazilian electric utilities expanded at an average annual rate of almost 14% in the 1973-75 period and is expected to increase by an average rate of 8% annually from 1975 through 1980. It is anticipated that about $1 billion in capital investment will be devoted to power generation in 1980, up $114 million from the 1974 figure (see table 4). Capital investment in transmission and distribution is projected to reach $1.2 billion in 1980. The new transmission and distribution equipment will be needed to cover the increased distances between new generating plants and consumers. Efforts will be focused on integrating interregional and regional systems in order to utilize more efficiently the energy potential of all regions and to provide energy to areas having limited sources of supply.

[1] Characteristics of electric power supply are as follows: normal voltage in most cities is 127/220 V, 60 hertz, 3-phase; other voltages exist, including 220/380V in Brasilia, O.F. It should be noted that voltage lines with 50 hertz still exist in Brazil, making integration of interregional systems difficult. The metric system of weights and measures is the standard.

Table 4.—Brazil: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in millions of U.S. dolars) [1]

	1973	1974	1980
Generation (Fossil, nuclear, and hydro)	819	889.0	1,003
Transmission [2]	342	382.5	577
Distribution [2]	214	291.0	627
Miscellaneous	78	47.0	—
Grand Total	1,453	1,609.5	2,207

[1] For exchange rates, see table 1.

[2] "Transmission" includes substations, and "distribution" includes general installations.

Source: Centrais Eletricas Brasileiras S.A. and Bureau of International Commerce, Office of International Marketing research study.

The utilities sector's expenditures for generation equipment totaled slightly over $127 million in 1973, $151 million in 1975 and are forecast to exceed $208 million in 1979 (see table 5).

Purchases of power boilers equaled $20.6 million in 1974 and are projected to reach $25 million in 1979. Since hydropower plants constitute the lion's share of Brazil's electric energy system, a large demand is foreseen for hydraulic turbines. Expenditures for them are likely to amount to $60 million in 1979, up about $20 million from 1975's total, and will probably account for about one-fifth of total equipment expenditures by electric utilities in 1979. Expenditures for hydraulic turbine generator sets and AC generators (with a capacity of more than 50 MW) are expected to climb from $80 million in 1975 to about $108 million in 1979, comprising one-third of total electric utility expenditures in both years.

Spending for large power transformers grew from $6.6 million in 1972 to $10 million in 1975; it is expected to climb to $15 million in 1979. All large power transformers are imported, and this situation is likely to continue. Expenditures for power regulators and boosters reached almost $3 million in 1972, fell sharply in the following two years and then rose to $4 million in 1975. The market is forecast at $6 million for 1979. Expenditures for control circuit relays, $6 million in 1975, are expected to reach $9 million in 1979, with the bulk of the purchases continuing to be imported.

Four major government-controlled organizations oversee the generation, transmission, and distribution of electric energy in Brazil: (1) The Ministerio de Minas e Energia has overall responsibility for mining, and both convertional and nuclear generated electrical energy; (2) the Comissao Nacional de Energia Nuclear (CNEN) is the principal Brazilian organization concerned with the nuclear generation field. This commission integrates Brazilian nuclear activities, establishes nuclear policy, and coordinates program development. In the process, the commission trains technical and scientific personnel, encourages research and development activities, seeks native nuclear minerals, and draws up guidelines for purchases of nuclear reactors. (3) the Empresas Nucleares Brasileiras (Nuclebras), under CNEN's auspices, plans and executes the Brazilian nuclear program. The organizational position of Nuclebras is still being defined by Brazilian authorities, but one of its key functions is the implementation of the Brazil-West Germany Nuclear Agreement; (4) Centrais Eletricas Brasileiras S.A. (Eletrobras) undertakes and finances studies and projects related to the construction and operation of generating plants and electric transmission and distribution systems. It also controls commercial tariffs and establishes norms for bidding on electric power projects. Eletrobras conducts its activities through 25 major government-controlled companies, the largest of which is Centrais Eletricas de Sao Paulo S.A. (CESP), and one private electric utility company in Brazil.

Table 5.—Brazil: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	18.7	14.9	20.6	19.0	25
Nuclear reactors	104.0	—	—	—	—
Turbine generator sets					
Steam	2.6	1.0	3.7	4.0	3
Gas	.1	—	—	—	—
Hydraulic	29.0	28.8	2.8	40.0	60
Motor generator sets					
Diesel	—	10.2	3.6	8.0	11
Other	2.2	1.0	.5	.5	1
Other generators [2]	45.2	71.9	8.2	80.3	108
Total	201.8	127.8	39.4	151.8	208
Transmission and distribution equipment					
Small power transformers	2.4	5.8	19.1	6.0	8
Large power transformers	6.6	9.6	13.5	10.0	15
Other transformers	4.2	1.0	3.2	4.0	4
Power regulators and boosters	2.8	0.1	0.6	4.0	6
Switchgear	99.3	37.5	90.6	45.0	68
Power circuit breakers	10.4	3.8	4.9	4.5	6
Control circuit relays	3.9	2.5	11.1	6.0	9
Other transmission and distribution equipment	6.1	5.9	9.8	9.5	11
Total	135.7	66.2	152.8	89.0	127
Grand Total	337.5	194.0	192.2	240.8	335

[1] For exchange rates, see table 1.

[2] Consists almost entirely of hydraulic turbine generator sets and large AC generators.

Source: Brazilian Bureau of International Trade and Bureau of International Commerce, Office of International Marketing research study.

In 1973, the Federal Government of Brazil accounted for the major share of the Brazilian electric utility ownership, followed by state governments (see table 6).

A key private firm which generates 20% of the total electric energy is Light-Servicos de Electricidade S.A. (a subsidiary of BRASCAN Ltd. of Canada). It distributes 49% of the country's total generated electricity and 83% of the energy generated by CESP.

In the 1975-82 period, new construction and large power plant expansion are planned for a minimum of 134 hydroelectric generating units (see table 7). The Brazilian Government also plans to build fossil (coal) steam plants near coal mines, principally in the states of Rio Grande do Sul and Santa Catarina. Construction of medium-size or large fossil (particularly oil) steam plants is to be avoided. The focus will be on hydroelectric and nuclear power plants. According to government policy, nuclear power plants will gradually be substituted for fossil steam plants, but hydroelectric generation will continue to be expanded (see figure 2). In 1974, about four-fifths of the generating plants were hydroelectric, with the remaining one-fifth the fossil steam type. Hydroelectric generation plants are expected to account for 84% of the total capacity in 1980, while fossil steam and nuclear steam will probably comprise 14% and 2%, respectively. Pumped storage, gas turbine, internal combustion. geothermal, and solar forms of generation are not presently used, nor is installation expected by 1980.

In 1972, construction was begun on Brazil's first nuclear plant, Alvaro Penteado, in Angra dos Reis, and commercial operations are expected to begin in 1977. The plant will generate approximately 626 MW at the start; plans for expanding capacity to 3,000 MW, with two more nuclear reactors, are expected to be implemented by 1983. Further plant construction is anticipated for the 1980-87 period, with the addition of another six reactors, which are expected to be in operation by 1990. Power generation in all nuclear plants will be effectuated by pressurized water reactors. Electric energy officials expect a total installed nuclear capacity of about 10,200 MW at the end of 1990. No firm decision has been made on the locations of the new plants, but they will probably be situated in the coastal areas of the states of Sao Paulo and Espirito Santo and near the Sao Francisco River.

Table 6.—Brazil: Composition of electric utilities by ownership, 1973

	Number of utilities	Percent of total generating capacity
Private	1	20.6
Federal	15	42.5
State	10	30.1
Cooperative and small private companies	NA	6.8
Total	26	100.0

Source: Centrais Eletricas Brasileiras S.A. and Bureau of International Commerce, Office of International Marketing research study.

Table 7.—Brazil: Current and planned construction/ expansion of electric power plants, 1975-82 [1]

Type	Number of units added [2]	Total generating capacity added (MW)
Hydroelectric	134	43,572
Nuclear	1	626

[1] Only large power plant expansion and new construction are included. A detailed breakdown of individual construction projects giving such information as name of contracting engineer, starting and expected completion dates, costs, etc. can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] Figure given is a minimum. In some instances, the number of units has not been established.

Source: Centrais Eletricas Brasileiras S.A.; Centrais Eletricas de Sao Paulo S.A.; and Bureau of International Commerce, Office of International Marketing research study.

To implement the Brazil-West Germany Nuclear Agreement, Nuclebras will probably coordinate the activities of 11 companies that will build nuclear power and enriched uranium plants. Kraftwerke Union (50% Siemens AG, 50% AEG Telefunken International AG) is expected to be one of the leading German companies in the Brazilian nuclear program, supplying eight nuclear reactors by 1990.

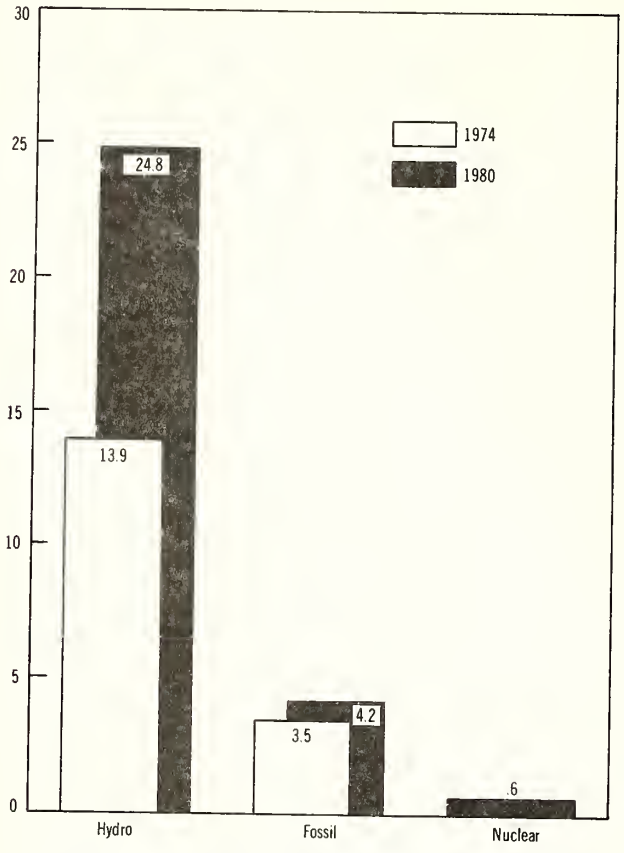
Industrial end users.—Sales of electric power equipment to industrial end users are projected to climb from $183.5 million in 1975 to $289 million in 1979, exhibiting an average annual rate of growth of 12%. Industrial customers accounted for 40% of total sales in 1975, and trade sources expect that proportion to increase to 42% by 1979. The industrial end user is a substantial consumer of a variety of electric energy systems equipment, most notably power boilers, steam turbines, diesel motor generator sets, and other generators.

Purchases of generation equipment by industry are forecast to grow at an average annual rate of 12% in the 1975-79 period, with purchases probably continuing to be sporadic. The largest generation plants are found in the pulp and paper, petrochemical, and metalworking industries; some small power plants are being built for agricultural purposes. The largest projects expected to be implemented in the next few years are the Camacari project in the State of Bahia, and the Jari project in the State of Para.

The industrial sector's expenditures for transmission and distribution equipment are forecast to grow

Figure 2.—Brazil: Electric utility generating capacity, 1974 and projected 1980

(in gigawatts)



Source: Centrais Eletricas Brasileiras S.A. and Bureau of International Commerce, Office of International Marketing research study.

from $122.4 million in 1975 to $193 million in 1979. Much of the equipment will be placed in areas remote from established distribution networks.

Original equipment manufacturers (OEM).—Purchases of generation equipment by original equipment manufacturers are forecast at $14 million for 1979, with transmission and distribution equipment expenditures at $45 million. The average annual growth of total purchases in the 1975-79 period is projected at about 8%. OEM purchases accounted for about 10.8% of total electric power equipment sales in 1975, but that proportion is expected to fall slightly in 1979.

The domestic equipment industry is a significant market for imported components and instrumentation; some key customers are Siemens S.A., Asea Electrica S.A., General Electric do Brasil S.A., and Industria Eletrica Brown Boveri S.A. Generation equipment needed by these original equipment manufacturers encompasses motor generators, parts for all types of generators, and components for power boilers and steam turbines. Transmission and distribution equipment required includes control circuit relays, circuit breakers, switches, and parts for control boards.

Government (other than utilities).—The value of government expenditure for both generation equipment and transmission and distribution equipment reached only about $850,000 in 1974, having declined from over $6 million in 1973. However, in 1975 expenditures rebounded to $2.7 million. The projected value of government purchases in 1979 is about $4 million, .6% of the total electric energy systems market. Much of the transmission and distribution equipment the government purchases consists of mobile and portable units.

New Technology/Alternative Sources of Energy

The most significant technological development to be implemented in Brazilian electric energy systems is the construction of EHV transmission systems. EHV is to be used by the Itaipu plant in southern Brazil for transmission of generated energy to consumers in the southeastern and southern regions, and by northern generation plants as yet only in the

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on Brazil is available on a continuing basis from:

Country Marketing Manager—Brazil
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 321-8543

The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electric Energy Systems—Brazil." DIB 76-02-504, August 1975.

planning stage (such as Tucarai) for transmission to consumers in the northern, northeastern, and southeastern regions.

Solar energy is just beginning to be investigated by Brazilian scientists, mainly through their university affiliations. Instituto de Pesquisas da Marinha is building a solar collector to produce 35 kW of electrical energy and hot water units installations at the Universidade do Mar, in Cabo Frio, Rio de Janeiro. Electrical energy will be produced through thermal machines utilizing solar heat as a hot source, sea water as a cold source. During the 1974-77 period, governmental financial support for research on solar energy is expected to total $2.5 million. Geothermal generation is also being academically investigated, but without government support.

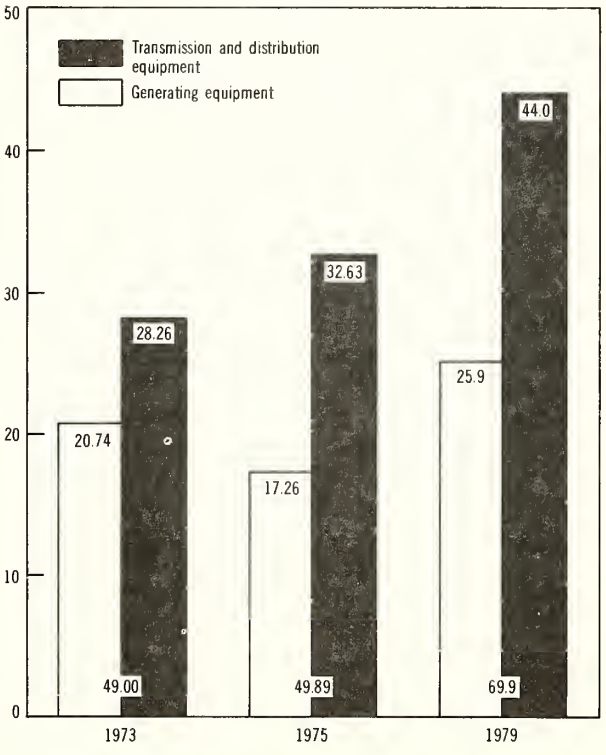
Electrical Energy Systems
Colombia

Colombia presents a substantial, growing market for electrical generation, transmission and distribution systems—purchases rose from nearly $47 million in 1972 to more than $56 million in 1974 (see table 1). Expenditures for electrical power equipment are projected at $70 million annually by 1979.

Transmission and distribution equipment sales topped $36 million in 1974, accounting for 64% of the market, and should maintain this percentage for the remainder of the decade (see figure 1). Demand for this equipment will be spurred by the growth in urban population, extension of rural electrification, development of a nationwide system connecting the major power generation centers, and anticipated expansion in several industrial areas.

Figure 1.–Colombia: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Colombian statistics and trade source estimates.

Consumption of generation equipment is projected to rise from $20 million in 1974 to $26 million in 1979. Sizable investment in hydroelectric projects should increase demand for hydraulic turbines and generator sets.

U.S. firms have been slow to enter the Colombian electric energy systems market, and their sales totaled just under $13 million in 1974. However, recent currency realignments have made U.S. prices more competitive, and trade sources project sales exceeding $22 million in 1979.

All large generating plants constructed in Colombia are built by foreign engineers working through local firms. The large number of upcoming projects offer very promising opportunities for U.S. consultants and contractors and, through them, for equipment manufacturers.

Competitive Environment

Colombian end users import most of their electrical power equipment, although an increasing amount of transmission and distribution equipment is being locally supplied. Very little generation equipment is produced by domestic manufacturers (see table 2).

Imports.—Electrical power equipment imports totaled nearly $35 million in 1974 and are projected at $56 million in 1979 (see table 3).

U.S. firms supplied 25% (or $8.3 million) of the electrical generation, transmission and distribution

Table 1.—Colombia: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	12.2	17.3	16.4	13.7	20
Transmission and distribution equipment	21.0	19.0	24.7	22.3	30
Total	33.2	36.3	41.1	36.0	50
Industrial companies					
Generation equipment	2.8	2.9	3.2	3.0	5
Transmission and distribution equipment	10.0	8.9	11.1	10.0	13
Total	12.8	11.8	14.3	13.0	18
Government (other than utilities)					
Generation equipment	.4	.6	.6	.6	1
Transmission and distribution equipment	.3	.3	.4	.3	1
Total	.7	.9	1.0	.9	2
Grand Total	46.7	49.0	56.4	49.9	70

[1] All figures converted at the following rates: 1972—US$1 = Col $22.02; 1973—US$1 = Col $23.81; 1974 and thereafter—US$1 = Col $28.00.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Colombian statistics and trade source estimates.

equipment imports in 1973 and increased their share to 37% in 1974, as American manufacturers became more price competitive with other suppliers. U.S. manufacturers are forecast to supply nearly 43% of the imported generation equipment and 37% of the foreign-made transmission and distribution products in 1979.

Major third-country competitors in the Colombian electrical power equipment market are: Mitsubishi of Japan, Brown Boveri of Switzerland, and AEG Telefunken and Siemens of Germany. Between 1965 and 1974, Mitsubishi sold 14 generators and more than 100 high-capacity transformers for hydroelectric projects, and 1 turbogenerator set for a coal steam plant. Siemens constructed a 132-MW thermoelectric plant in the city of Barranquilla. An important factor in the success of these companies has been aggressiveness of their countries' contracting engineering firms.

Trade and Technical Regulations.—All imported electrical power equipment, except that originating in the countries of the Latin American Free Trade Association (LAFTA) and the Andean Common Market (ACM), is subject to customs duties ranging from 2 to 62% of the c.i.f. value; LAFTA and ACM origin equipment enjoys lower rates. However, goods purchased by public agencies are exempt from regular import duties and sales tares. Heavy machinery used for the development of basic industries, including power generation and transmission, is also exempt from the sales tax, which ranges from 6 to 35% of the c.i.f. value.

Additional tariffs include 5% of c.i.f. value assessed for the export promotion fund, 1.5% for general government development plans, and 1% for an ad valorem fee to approve the consular invoice. Some types of electrical power equipment imports require an import license from the Colombian Institute of Foreign Trade (INCOMEX).

Countries in the Latin American Free Trade Association are given preferential rates on permanent magnets and transformers with capacities ranging from 1,000 kVA to 100,000 kVA.

Within the Andean Common Market, a minimum external tariff protects intraregional production assigned to member countries by the Program for the Development of the Metal Working Sector. Equipment covered by this agreement includes switches, cutouts, and changeovers for operational voltages of over 1,000 V and rated capacities of more than 400 amps, some transformers and inductive coils, and electromagnets, automatic voltage regulators, multiphase motors, and rotary converters.

The Colombian Electric Energy Institute (ICEL) has written a Technical Standards Manual, used by its subsidiaries and affiliates and by other electric utilities, which provides detailed specifications for all components of transmission and distribution systems.[1] The Colombian Technical Standards Institute (INCOTEC) has developed standards for all residential, commercial, and public lighting installations. These specifications, based on U.S. requirements, are implemented through the electric utilities and local manufacturers and importers. Information on the availability of published standards in Colombia may be obtained from the National Technical Information Service. Technical Help to Exporters, Springfield, Virginia 22161.

Trade Practices.—All equipment for major utility projects is purchased through competitive bidding that is open to both foreign and domestic companies provided they have preregistered and met the buyer's qualifications. Domestic contracting engineers generally do not compete for the construction of large projects because they lack the necessary financial capability and equipment. U.S. firms have won a number of these contracts and the potential exists for a much greater presence in the market. Local consulting firms conduct most of the preliminary studies for electrical generation, transmission, and distribution projects and are very important in purchasing decisions for both utilities and industry.

[1] Colombia uses the metric system. The electric power supplied to industry is 13,200 V with a secondary power distribution of 220/110 V and 60 hertz. Bogota is an exception, with a primary distribution system of 11,400 V and a secondary system of 260/150 V. However, the Electrical Supply Company of Bogota is in the process of adapting its system to the country's overall standards.

Table 2.—Colombia: Major suppliers of electrical power equipment

Domestic manufacturers

Radio Tecnica Colombiana
Single- and 3-phase, HV and LV transformers

Transformadores de Pereira Ltda.
Single- and 3-phase HV transformers

Fabrica de Alambres Tecnicos, S.A.
Electric cords and wires, including high-tension cables, magnetic wires

Electronica Andina Ltda.
Condensers

Ceat General de Colombia S.A.
Cables

Industrias de Ingenieria Mecanica S.A. (subsidiary of Foster Wheeler, Orr Sembower, and Riley Stoker Corp., U.S.)
Water and fire tube boilers and auxiliary equipment such as preheaters, ash collectors, soot blowers

Fabricas Colombianas de Materiales Electricos S.A. (L. M. Ericson and A. B. Aulis, Sweden)
Cables and wires, current-carrying wire devices

Sola Basic TYF S.A. (Sola Basic Industries, U.S., 49%, and Sola Basic Limited, Canada, 26%)
Single- and 3-phase, HV and LV transformers

Siemens Colombiana S.A. (Siemens and AEG-Telefunken, Germany)
High-capacity transformers, small 3-phase motors, fans

United States manufacturers

Westinghouse Electric Co.
Generators, transformers, electric controls, motors, protection relays, steam and gas turbines, complete electric substations

General Electric
Distribution transformers and protective equipment, insulators, DC motors and generators, large generators, diesel motors, switchgears, steam turbines, etc.

A. B. Chance Co.
Insulators, conductors, connectors

Foster Wheeler Corporation
Steam boilers and condensers

Solar International Harvester
Gas turbines, turbogenerators

Cooperweld Steel International Co.
Transmission cables and wires

GYW Specialty Co.
Equipment and special accessories for HV transmission systems

Alcan Aluminum Co.
Aluminum electric conductors and accessories

Third-country manufacturers

Mitsubishi Electric Corporation (Japan)
Full line of generators and transmission and distribution equipment

AEG Telefunken (Germany)
Generators, transformers, and electric transmission and distribution equipment

Siemens S.A. (Germany)
Complete hydroelectric and thermoelectric plants, substations for electric distribution, switchboards

Brown Boveri (Switzerland)
Generators, transformers, switchboards, motor starters, automatic control systems, circuit breakers, switches, contactors, motors, fuses, changeovers

Oerlikon (Switzerland)
Diesel motors, generators

G.E. Limited (United Kingdom)
Large transformers, high-capacity circuit breakers

Telemecanique (France)
Contactors, switches, motor starters, protection relays, controllers

Source: Bureau of International Commerce, Office of International Marketing research study.

When Colombian engineers require additional technical capability for a particular project, they either associate with a foreign consulting company or hire one or two foreign experts.

Domestic production.—The value of Colombian-manufactured electrical power equipment in 1972 was approximately $17 million. Manufacturers have incorporated a large percentage of locally made components into their transformers, conductors, boilers, and LV switches; components are imported for items such as small motors, circuit breakers, control and distribution switchboards, HV switches, condensers, and lightning steel for transformer cores, circuit breakers, monitoring and control equipment and isolating materials. Local products are well made, but many construction firms and industrial contractors still prefer imported equipment.

The most important domestic manufacturers are either subsidiaries or licensees of foreign firms, or are partially foreign-owned. For example, Siemens Colombiana supplies more than 40% of the local transformer market, while Sola Basic TYP provides 13%. A major exception is Industrias de Ingenieria Mecanica (DISTRAL) S.A., which has produced almost all of the boilers installed for steam-electric generation projects since 1970.

Wholly Colombian-owned enterprises lack sufficient technology and capital to expand substantially. They also find it difficult to plan production in a sector that depends largely on government electri-

Table 3.—Colombia: Estimated imports of electrical power equipment, 1973, 1974, and 1979
(in millions of U.S. dollars) [1]

	1973 [2]	1974	1979
Generation equipment			
United States	2.7	6.2	10
Japan	5.8	3.8	4
Germany	.5	1.1	3
Spain	.5	.3	3
United Kingdom	.3	.3	1
All others	5.1	2.2	3
Subtotal	14.9	13.9	24
Transmission and distribution equipment			
United States	5.6	6.7	12
Germany	2.3	3.2	4
United Kingdom	3.3	2.4	3
Spain	.5	2.1	3
Japan	1.8	1.4	3
All others	4.5	5.1	7
Subtotal	18.0	20.9	32
Totals			
United States	8.3	12.9	22
Japan	7.6	5.2	7
Germany	2.8	4.3	8
United Kingdom	3.6	2.7	4
Spain	1.0	2.4	5
All others	9.6	7.3	10
Grand Total	32.9	24.8	56

[1] For exchange rates, see table 1.
[2] Does not include June and July data.
Source: Import applications at INCOMEX and Bureau of International Commerce, Office of International Marketing research study.

fication programs. Initial steps have been taken within the framework of the Andean Common Market to regionally integrate the electric power equipment manufacturing industry, in order to create larger demand and permit economies of scale.

The tendering process favors local producers who are capturing increasingly larger shares of the market. Colombian bidders are entitled to preferential consideration under a "Buy Colombian" law, provided the goods do not contain a high portion of imported components.

To promote exports, Colombia has established a special import/export system which allows machinery and raw materials imported for assembly into goods for export to enter the country exempt from customs duties and some other tariffs. Some electrical power equipment, such as small generators and components to be integrated into portable electric plants and transformers built for export, has been imported under this system.

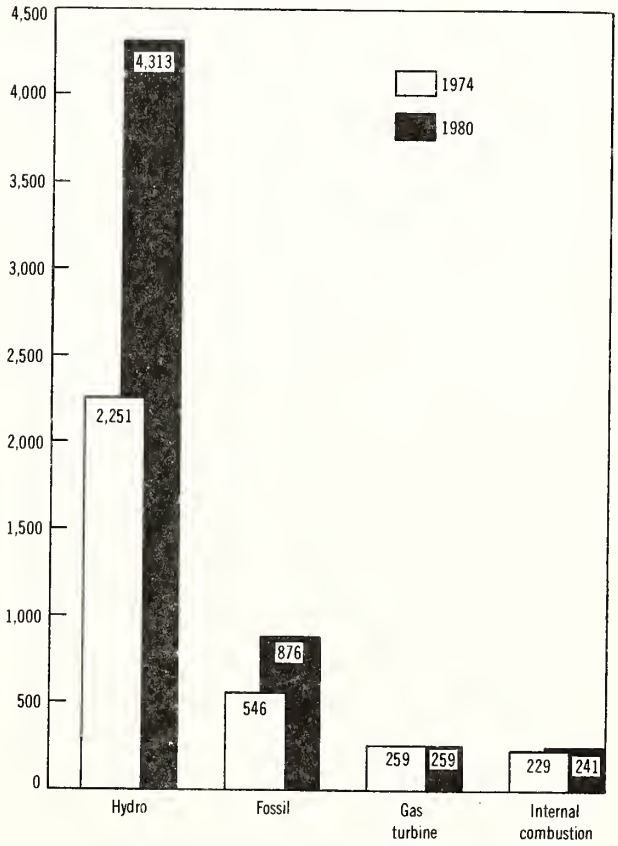
End Users

Electric utilities.—Colombia's electric utilities increased their generating capacity to 3,483 MW in 1975 and hope to add another 10 to 12% capacity yearly through 1980 (see figure 2). The country has made good use of its mountainous topography and water resources to develop large hydroelectric plants, which currently poduce 65% of the utility sector's electricity. These generation systems are usually based on conventional Pelton- or Francis-type turbines of medium capacity. The Atlantic Coast region is served exclusively by thermal generation plants burning fuel oil and natural gas, while many small towns operate diesel generators.

Capital expenditures by the utilities for electricity generation reached $84 million in 1974 and are projected at $109 million in 1980, with by far the largest share allocated for hydroelectric plants (see table 4). Hydraulic turbines and turbine generator sets are expected to account for about two-thirds of the generation equipment purchased by utilities in 1979 (see table 5). Colombia may reach the maximum possible development of its hydroelectric resources (around 40.000 MW to 50,000 MW) by the end of the century.

Figure 2.—Colombia: Electric utility generating capacity, 1974 and projected 1980

(in megawatts)



Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Colombian statistics and trade source estimates.

Table 4.—Colombia: Estimated capital expenditures by electric utilities, 1974, 1975, and 1980
(in millions of U.S. dollars) [1]

	1974	1975	1980
Generation			
Fossil	12	17	16
Hydro	70	58	93
Internal combustion	2	3	—
Total	84	78	109
Transmission	4	11	15
Distribution	67	63	87
Grand Total	155	152	211

[1] For exchange rates, see table 1.
Source: ICEL and Bureau of International Commerce, Office of International Marketing research study.

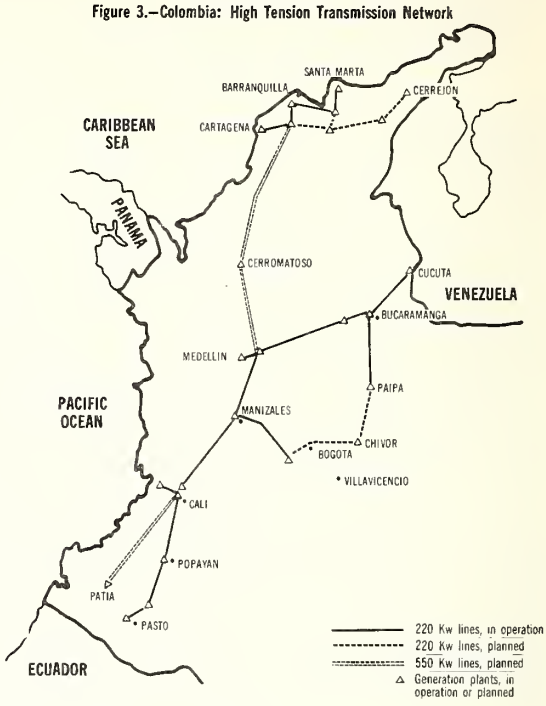
Some fuels are also in limited supply—the country began importing natural gas in 1974 and will probably become a net importer of petroleum products by mid-1977. The National Institute for Nuclear Affairs (IAN) has recommended that studies be started immediately on the investments needed to build atomic generation plants. Preliminary surveys indicate that Colombia has important deposits of radioactive minerals, but the development of nuclear power is still many years away. The Government is also placing great emphasis on the development of the coal industry, and many trade sources believe that coal-powered steam generation of electricity is the country's best future source of energy.

Largely because of the mountainous terrain, independent electric energy systems grew up around Colombia's major cities. In 1967, the Government began efforts to link the principal electric utility companies with a high-tension transmission system (see figure 3). The interconnected 220/115kV network now being built will cover 544 kilometers (km). A 500-kV system is under construction to connect the Atlantic Coast region to hydroelectric plants in the rest of the country, alleviating the eastern coastal area's dependence on expensive fuels.

Capital investment in the transmission and distribution of electricity is expected to increase from $71 million in 1974 to $102 million in 1980. Studies are also being conducted on the feasibility of adding a further 2,633 km of transmission lines between 1975 and 1982.

The Colombian Government controls all electric utilities through various national, regional, state, and municipal entities (see figure 4). All large electrification projects must receive final approval from the President of Colombia after being reviewed and approved by the Ministry of Mines and Energy, the National Planning Department (DNP), and two advisory bodies which help establish general policy, recommend priorities, and assure effective cooperation between different groups in the electric power sector.

Figure 3.—Colombia: High Tension Transmission Network



Source: *Colombia Today*, Vol. 10, No. 4 (1975)

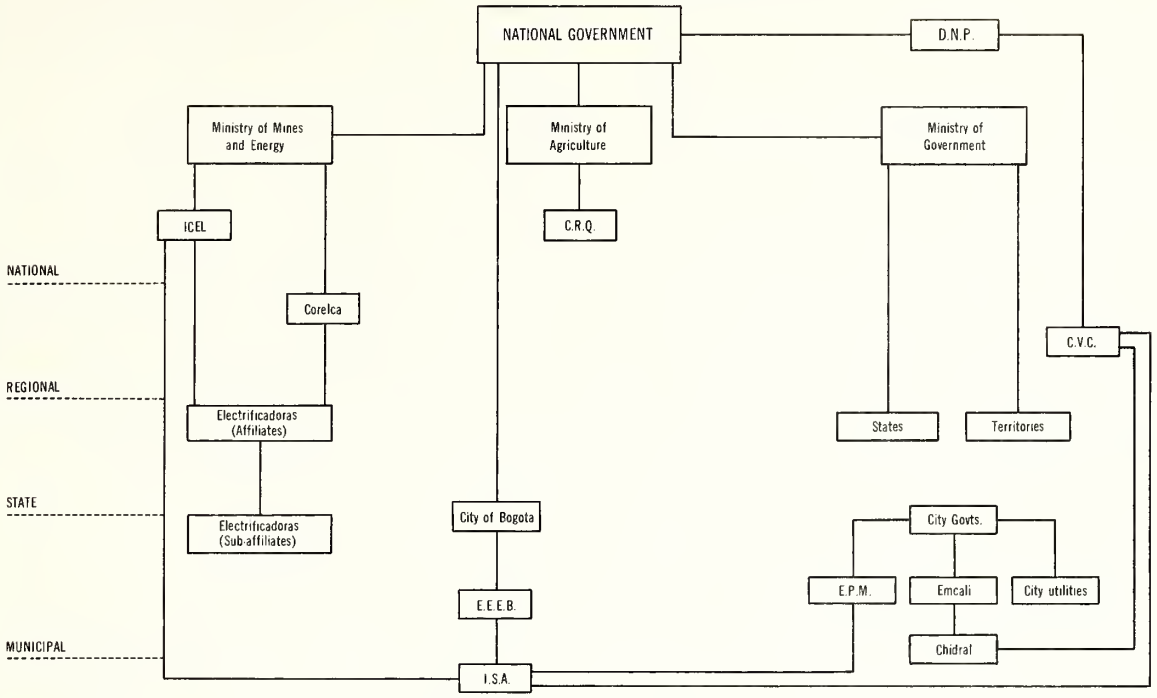
The Ministry of Mines and Energy oversees ICEL and the Electric Corporation of the Atlantic Coast (CORELCA). The Ministry of Agriculture regulates the country's water resources, including hydroelectric projects, and contains the Regional Corporation for the Development of the State of Quindia (CRQ) which carries out small-scale rural electrification plans.

The Electric Energy Section of the DNP approves the budget for several electric agencies such as ICEL and CORELCA and supervises development of the electric sector. The agency also oversees the Autonomous Corporation for the Development of the Cauca Valley (CVC), which regulates electricity in that area. The Electrical Interconnection Corporation (ISA) has chief responsibility for controlling and coordinating the integration of the country's generation centers.

ICEL acts primarily as the entity in charge of preparing and coordinating the National Electrification Plan. It also carries out generation, transmission, and distribution projects and, through its 19 affiliates and 9 subaffiliates, services all the states in Colombia except Quindio, Risaralda, and Valle del Cauca. ICEL had total assets of around $252 million and an annual budget of $1.7 billion in 1975.

In 1974, ICEL controlled more than 26% of the country's generating capacity. Over 40% of capacity was in the hands of two municipal companies,

Figure 4.—Colombia: Institutional Structure of the Electricity Sector



Source: Bureau of International Commerce, Office of International Marketing research study.

Table 5.—Colombia: Estimated equipment expenditures by electric unities, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	4.7	4.8	5.6	1.8	2
Turbines					
Steam	.3	5.8	.3	1.5	2
Gas	.5	.2	.8	.5	1
Hydraulic	1.5	3.8	.5	3.3	7
Turbine generator sets					
Steam	1.7	.3	2.8	1.1	1
Gas	.4	.1	.7	.4	1
Hydraulic	1.5	.3	2.5	2.5	5
Diesel motor generator sets	1.6	2.0	3.1	2.6	1
Total	12.2	17.3	16.3	13.7	20
Transmission and distribution equipment					
Transformers	7.3	6.6	8.3	8.9	11
Other transmission and distribution equipment	13.7	12.4	16.4	13.4	19
Total	21.0	19.0	24.7	22.3	30
Grand Total	33.2	36.3	41.0	36.0	50

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Colombian statistics and trade source estimates.

the Bogota Electric Energy Enterprise (EEEB) and the Medellin Public Utilities Enterprise (EPM), which will soon have the largest generation system in the country. CVC regulated 18% of the electric utilities capacity, and CORELCA was in charge of 12%.

According to ICEL estimates, Colombia will have to invest at least $2.4 billion during the 1974-83 period for expansion of the electric sector. Of this amount, 52% will be spent on generation projects, 42% on distribution, and 6% on transmission. This includes $1.1 billion spent on hydroelectric projects, $106 million on fossil fuel steam generation, and $9 million on diesel generation plants. ICEL estimates that nearly 39% of the financing for these projects will come from foreign credit.

At least five hydroelectric plants, with a total capacity of 3,390 MW, are scheduled for construction in the 1975-85 period (see table 6). Only 198 MW in fuel oil and 191 MW in coal steam plants will be added to the system by 1985. The coal steam plant will be constructed as part of the Correjon coal mining complex in the State of Guajira at an approximate cost of $26 million.

Among Colombia's major electric transmission and distribution projects planned for 1975-80 is the construction of the Atlantic Coast-San Carlos 500-kV link. Operation of the first circuit is expected during the 1978-81 period. The transmission line will have two independent 520-km circuits and will require the construction of four substations; $64 million is budgeted for the transmission line and $31 million for the substations.

Table 6.—Colombia: Current and planned construction/ expansion of hydroelectric power plants, 1975-85 [1]

	Number of units added	Total generating capacity added	Total cost (in millions of U.S. dollars) [2]
Chivor II	4	500	109
San Carlos I	4	620	280
Mesitas-La Huaca	6	520	110
Salvajina	3	210	38
Patica	4	1,540	473

[1] A complete listing of construction projects both planned or under study, giving such information as name of contracting engineer, starting and expected completion dates, costs, etc., can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] For exchange rates, see table 1.

Source: ICEL and Bureau of International Commerce, Office of International Marketing research study.

ISA also plans to establish a network of control and communication stations to supervise its electric power transmission operations through telemetry; costs for this project are estimated at $13 million.

The National Rural Electrification Plan (PNR) is projected to supply electric power to about 228,000 families at a total cost of $110 million, with $36 million allocated for imported materials and equipment. The plan will be carried out by ICEL and its regional electric utilities under the DNP's Integrated Plan for Rural Development.

Equipment needed to carry out the proposed projects includes the following:

- Hydraulic turbines (Pelton and Francis types) for over 60 MW
- Dynamos and alternators for over 100 kW
- High-capacity hydraulic generators
- Diesel motor generator sets for over 100 HP and 120 kW
- Distribution transformers for up to 500 kVA
- Power transformers for over 1,000 kVA and more than 35,000 V
- Static converters
- Electric switches, fuse cutouts, and changeovers for more than 260 V and over 30 amps rated capacities
- Circuit breakers for over 1,000 V and more than 400 amps rated capacities
- Automatic voltage regulators
- Distribution switchboards for up to 15 kV and master controls for up to 110 kV
- Meters: ph, frequency, load, temperature, flow, and pressure
- Pressure pipes
- Valves, pumps, and compressors for hydroelectric projects
- HV power conductors for transmission lines
- Ball and socket disc-type insulators
- Transmission line fittings

Industrial end users.—Colombian industries, both private and public-owned, spent over $13 million for electric power equipment in 1975 and anticipate expenditures of over $18 million in 1979. Transmission and distribution equipment account for about three-fourths of these purchases.

The major manufacturing industries in Colombia include textiles, cement, sugar, paper, beverages, chemicals, and petroleum products. About 90% of all manufacturing is concentrated in six main metropolitan areas—Bogota, Medellin, Cali, Barranquilla-Cartagena, Manizales-Pereira-Armenia, and Bucaramonga. From one to four firms account for the bulk of production in each sector and, in some cases, completely monopolize the market. These are the firms that undertake important expansions or construction of new facilities and are second only to the electric utilities as principal users of electrical energy systems.

Ecopetrol, the government petroleum company, builds its own generation plants for its petroleum extraction, refining, and transportation complexes. Some of the major projects being considered for implementation within the next 5 years include a new refinery with capacity of 75,000 barrels per day (bpd), costing $180 million; a refinery for 25,000 bpd; a 230,000-MT aromatic plant; a 500-

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on Colombia is available on a continuing basis from:

Country Marketing Manager—Colombia
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 321-8543

The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Colombia," DIB 75-12-502, July 1975."

MT terephthalic acid plant; a $35-million expansion of an ethylene plant; two new ammonia plants, each with 100,000-MT capacity, at a total cost of over $600,000; and a number of pipelines.

Other important users of electrical power equipment will be major airports, construction firms and hospitals. Within the next 5 years, the Department of Civil Aviation hopes to install or modernize essential ground support equipment in airports, including the central electric stations and distribution networks at several airports; start construction of a new airport for Medellin; and build a new airstrip and passenger terminal for El Dorado Airport in Bogota. The development of the construction industry is one of the main targets of the present Government, and contracting firms continue to be good contacts for the sale of electrical energy systems equipment. The National Hospital Fund is financing the acquisition of electric plants for public hospitals all around the country.

New Technology/Alternative Sources of Energy

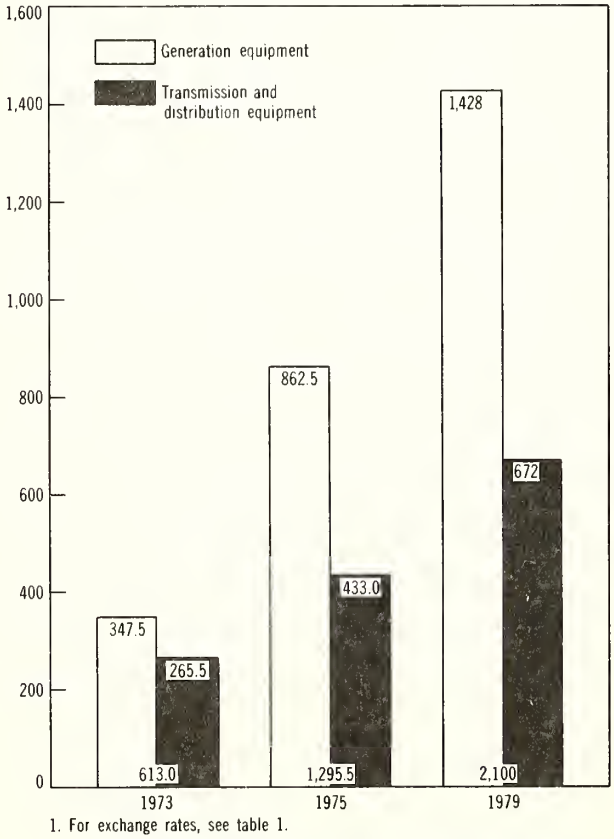
The Government of Colombia is sponsoring limited research in the areas of solar and geothermal energy. The Colombian Fund for Scientific Investigation (COLCIENCIAS) and the Industrial University of the State of Santander (UIS) are conducting studies on the utilization of solar energy for generation of electricity in the Eastern Plains region. The State of Caldas' electrification company has developed preliminary studies on possibility of constructing a natural steam electricity generation project near the city of Manizales.

Electrical Energy Systems
France

Sales of electrical generation, transmission and distribution equipment in France increased $555 million to over $800 million in the 1972-74 period (see table 1). The Government's decision to support a massive nuclear power program helped push the 1975 market to almost $1.3 billion, and should bring total 1979 sales to $2.1 billion (see figure 1). This vast program will bring nuclear generating capacity from 10% of the national total in 1975 to almost 70% by 1985.

Figure 1.—France: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



1. For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official French statistics and trade source estimates.

Most design and contract work will be done directly by Electricite de France, the public utility, although American consultants and contractors have obtained a limited presence in France. Their share of the French consulting and contracting market could bring not only continued contracts in the country but also in former French colonies, who look to France for leadership in technical matters.

Competitive Environment

French manufacturers produce most types of electrical power equipment (see table 2). They provided 90% of the equipment and systems purchased in France in 1974 and, in spite of a growing volume of imports, they are expected to increase this share to about 95% by 1979.

Imports.—Electrical energy equipment imports exceeded $82 million in 1973, but declined slightly the following year. The nuclear power program is expected to create a more favorable import market, forecast to rise to over $100 million in 1979 (see table 3).

Transmission and distribution equipment represented about two-thirds of the total import market in 1973-74; they will increase modestly during the 1974-79 period, reaching $58 million in 1979. Growth of generation equipment imports are forecast to rise from $27.4 million in 1974 to $46 million in 1979.

In recent years U.S. suppliers have improved their position in this market. Their share rose from 21% of the import total in 1973 to 23% in 1974 and, in spite of strong third-country competition, is forecast to approach 27% in 1979, when sales of U.S.-made equipment will reach $28 million. Most imports from the United States consist of highly

Table 1.—France: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment..	265.0	295.0	425.0	805.0	1,365
Transmission and distribution equipment....	217.5	240.5	296.0	403.0	634
Total	482.5	535.5	721.0	1,208.0	1,999
Industrial companies					
Generation equipment...	40.0	42.0	44.0	46.0	50
Transmission and distribution equipment...	18.0	20.0	22.0	24.0	30
Total	58.0	62.0	66.0	70.0	80
Government (other than utilities)					
Generation equipment...	10.0	10.5	11.0	11.5	13
Transmission and distribution equipment....	4.5	5.0	5.5	6.0	8
Total	14.5	15.5	16.5	17.5	21
Grand Total	555.0	613.0	803.5	1,295.5	2,100

[1] All figures converted at the following rates: 1972—US$1=5.05 francs; 1973—US$1=4.45 francs; 1974 and thereafter—US$1=4.79 francs.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official French statistics and trade source estimates.

sophisticated equipment and instrumentation that is not manufactured in France.

American sales have been highest in the areas of transmission and distribution equipment. U.S. manufacturers provided about 20% of these imports in 1973-74, with annual sales of $11 million in both years. Trade sources expect American suppliers to expand these sales to around $12.5 million by 1979.

The nuclear power program will provide new sales opportunities for American-made generation equipment; imports of such equipment are forecast to reach $15 million in 1979, double the 1974 level. Peripheral and specialized equipment for nuclear generating facilities are expected to account for most of this expansion.

The principal U.S. manufacturers serving this market are General Electric and Westinghouse; their sales have been mainly in the nuclear field. The equipment supplied by General Electric has incorporated recirculation pumps from Byron Jackson, valves from Valin, Hammeldahl, Atwood, and Crosby, and seamless pipes from Cameron. Several American suppliers have subsidiaries in France. Among the most important of these are Amp Inc. (connectors and components), Allis Chalmers Corp. (generators), Cutler-Hammer Inc. (motor control components), Foster Wheeler Corporation (power plant equipment), Foxboro Company (measurement and control instruments), Robins and Myers, Inc. (electronic motors), and Sybron Corporation (instrumentation).

German suppliers led other foreign competitors in sales of electrical power equipment to France in 1973-74 with about 35% of total imports. Their marketing efforts have been most successful for transmission and distribution equipment, annual sales of which stand at about $20 million. Their sales of generation equipment were about $9 million in 1973 and 1974. German suppliers are likely to boost their generation equipment sales to an estimated $12 million by 1979, but will hold a second place to U.S. firms in supplying these imports to the French market.

The Netherlands, Belgium and Luxembourg are also important competitors; together they supply about 15% of France's power equipment imports. Pauwels of Belgium, one of the leading supplier firms, has been particularly successful selling transformers to the utility sector. The Italian firm, SACE, has gained a fairly strong position in sales of molded-case circuit breakers; trade sources estimate SACE's share of sales at close to 10%.

Trade and technical regulations.—Imports of electrical power equipment from outside the European Economic Community (EEC) are generally subject to duties ranging between 5% and 10%. Equipment manufactured outside the EEC which enters France via another EEC member is subject to an extra 2% of the original duty paid. A value added tax is also levied on incoming goods. Various nations enjoy progressive reductions for EEC duty rates or special duty-free status; these arrangements apply to trade with France as well as other EEC members.

Electrical specifications are established by the Electrical Technical Union (UTC); conformity is for most purposes mandatory.[1] Adherence to these specifications is commercially desirable even when compliance is not legally required, because insurance coverage in France is offered at lower rates when electric installations are certified by a panel of engineers as meeting UTC standards.

Information on the availability of published standards in France may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Several major American consulting and contracting engineering companies have associates or subsidiaries in France. To the extent that these firms incorporate American technology, particularly in control and instrumentation, in their designs, they stimulate sales opportunities for U.S. electrical energy equipment suppliers.

Domestic manufacture.—French manufacturers of electrical energy equipment have enjoyed a good

[1] The network voltage at mains level is 380 V, 3-phase, 50 hertz, with the equivalent single-phase voltage of 220 V. Some older buildings still have 110 V installation wiring, and this is served. The metric system of weights and measures is the statutory standard.

Table 2.—France: Major domestic suppliers of electrical power equipment

Domestic manufacturers

Alsthom
Turbogenerators and alternators

Alsthom-Savoisienne
Large power and systems transformers

Delle-Alsthom
HV switchgear

Jeumont-Schneider
Boilers, turbogenerators and alternators, and transformers (large power, systems, and distribution)

Atelier de Constructions Electriques de Metz
Transformers (large power, systems, and distribution)

Le Transformateur
Distribution transformers

Leroy Somers S.A.
Electric motors and alternators

Framatome (45% interest held by Westinghouse, U.S., 51% by Creusot-Loire, and 4% Jeumont-Schneider; licensee of Westinghouse, U.S.)
Nuclear reactors and boilers

Sogerca (licensee of General Electric, U.S.)
Nuclear reactors and boilers

Compagnie Electro-Mecanique—CEM (38% interest held by Brown-Boveri, Switzerland)
Turboalternators and generators, alternators, transformers (large power and systems), and switchgear

Creusot-Loire (licensee of Westinghouse, U.S.)
Boilers

Merlin Guerin (licensee of Westinghouse, U.S.)
Switchgear

Unelec
Distribution transformers and circuit breakers

Source: Bureau of International Commerce, Office of International Marketing research study.

domestic market, and with the vast investments planned for nuclear power development, their sales prospects are excellent for the next decade. Production for the domestic market totaled $722 million in 1974 and is expected to exceed $1.9 billion in 1979. Generation equipment will account for most of this growth; sales are forecast to increase from $452 million in 1974 to well over $1.3 billion in 1979. Sales of transmission and distribution equipment over this period are expected to climb from $270 million to $613 million. Almost all types of power equipment produced are exported. Approximately 50% of French companies' production of boilers, boiler house plant, turbogenerators, hydro generators, and diesel generation equipment is sold abroad. They also export substantial quantities of transmission and distribution equipment.

The domestic industry is currently concentrated in Paris and Lyon, but most new factories are being established in eastern France. The structure of the industry is complex, with many firms holding shares in other companies. Among the largest are the Compagnie General d'Electricite (CGE) group, Jeumont-Schneider, and Compagnie Electro-Mecanique (CEM). The CGE group in 1973 comprised seven firms: Alsthom, Alsthom-Savoisienne, Delle-Alsthom, Unelec, Arnould, Les Cables de Lyon, and Filotex. Additional firms are affiliated with the group through these seven constituents. The CGE group employs a total of 120,000 people and operates some 150 factories; total sales are around $3 billion. Most of the major domestic equipment manufacturers are affiliated with the Syndicat General de la Construction Electrique, the manufacturers' association.

Several French manufacturers compete for sales of generation equipment. Framatome and Sogerca are the chief domestic suppliers of boiler equipment for nuclear plants. Jeumont-Schneider is the leading supplier of turbogenerators, serving about 40% of that market; Alsthom and CEM are also major man-

Table 3.—France: Estimated imports of electrical power equipment, 1973, 1974, and 1979
(in millions of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	6.5	7.5	15.0
Germany	8.9	9.0	12.0
Netherlands	1.8	1.9	2.5
Belgium and Luxembourg	.9	1.0	1.5
All others	7.9	8.0	15.0
Subtotal	26.0	27.4	46.0
Transmission and distribution equipment			
United States	11.0	11.0	12.5
Germany	20.3	19.0	20.0
Netherlands	4.6	4.5	5.0
Belgium and Luxembourg	5.3	5.0	6.0
All others	14.9	14.0	15.0
Subtotal	56.1	53.5	58.5
Totals			
United States	17.5	18.5	27.5
Germany	29.2	28.0	32.0
Netherlands	6.4	6.4	7.5
Belgium and Luxembourg	6.2	6.0	7.5
All others	22.8	22.0	30.0
Grand Total	82.1	80.9	104.5

[1] For exchange rates, see table 1.
Source: Statistiques de Commerce Exterior de la France and Bureau of International Commerce, Office of International Marketing research study.

ufacturers in this field supplying about 30% each of this equipment purchased in France. All three turbogenerator manufacturers export a significant portion of their output. Some 10 firms produce diesel generators; among the largest are Jaeger and Soule. Chantiers de l'Atlantique also produce diesel generators and is one of the chief manufacturers of large (up to 100 MW) diesel units. Trade sources regard Leroy Sommers as the leading supplier of alternators below 1 MVA, serving around 60% of the market, while Unelc and CEM share the balance.

Nuclear reactors are built by Framatome and Sogerca. Framatome is jointly controlled by Westinghouse and Creusot-Loire; the latter interests, which are within the CGE group, hold the Westinghouse license for the pressurized water reactor. Sogerca, also within the CGE group through Alsthom, holds the General Electric license for the boiling water reactors.

The principal French transformer manufacturers are Alsthom-Savoisienne, Jeumont-Schneider, CEM, Atelier de Constructions Electriques de Metz (Metz), and Merlin Guerin. Large transformers (above 10 MVA) are made by all these firms except Merlin Guerin. Alsthom-Savoisienne supplies around 30% of this market, while Jeumont-Schneider and CEM are close competitors with some 25% each. Metz, which supplies about 15% of this equipment in France, manufactures transformers up to 200 MVA. Both Jeumont-Schneider and Alsthom-Savoisienne export a significant portion of their output.

Systems transformers are manufactured by the five major firms just mentioned; each company holds around 15-20% of the market, and imports supply around 5%. The same firms compete for sales of distribution transformers up to 630 kVA. However, Alsthom-Savoisienne, CGE, CEM, Jeumont-Schneider, and Merlin Guerin joined together in 1920 to form Le Transformateur to manufacture distribution transformers in the 800-1,000 kVA range. Le Transformateur's sales account for over a third of the distribution transformer market. Unelec, which represents CGE interests in this line, follows with about 20%, while Jeumont-Schneider and Merlin Guerin each hold 10-15%.

Delle-Alsthom, Merlin Guerin, and CEM-Gardy are the principal switchgear manufacturers. Delle-Alsthom, which recorded total sales revenues of $80 million in 1973, is considered by trade sources as the principal supplier, serving about 50% of the market for HV switchgear. This firm reportedly exports about 50% of its output. Merlin Guerin's total sales in 1972 were $136 million, when its HV switchgear sales accounted for about 35% of that market. CEM-Gardy, which achieved sales of $17.5 million in 1972, provides about 15% of the switchgear purchased in France. There is no domestic production of magnetic switchgear.

Most of the circuit breakers used in France are supplied by Merlin Guerin and Unelec; both firms have also been successful in exporting their products. Merlin Guerin is the leading supplier for molded case circuit breakers, serving about 55% of this market; it manufactures air circuit breakers in the 800-A to 3,000-A range, holding about 45% of total sales. Unelec manufactures about 45% of the air and 25% of the molded case circuit breakers.

End Users

Electric utilities.—Purchases by utilities, which account for about 90% of the electrical energy systems market, increased from $482 million in 1972 to $721 million in 1974 and are expected to continue this upward trend. The Government's decision to invest heavily in nuclear power facilities assures strong demand by this sector through the mid-1980's. The first thrust of this spending was evident in 1975, when equipment purchases exceeded $1.2 billion. The full implementation of plans for nuclear power plant construction is expected to bring these purchases to nearly $2 billion in 1979.

Capital expenditures for the sector totaled $1.3 million in 1974 and will exceed $3.8 billion in 1980 (see table 4). Investments in generating facilities are expected to more than double in the 1974-80 period, reaching $2.8 billion in 1980. Nuclear power plant construction will account for more than 85% of these expenditures. Expenditures for transmission and distribution equipment by the utilities totaled $296 million in 1974; investments of over $1 billion for transmission and distribution facilities are planned in 1980.

Electricite de France (EDF), a nationalized enterprise, is the nation's principal utility; it works closely with Gaz de France, the natural gas authority, sharing administrative staffs and operating joint regional offices for consumer relations, invoicing, and collections. EDF has headquarters in Paris and 24 regional offices, whose staffs participate in equipment selection. There are eight regions for thermal

Table 4.—France: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in millions of U.S. dollars)[1]

	1973	1974	1980
Generation	522	715	2,784
Transmission and Distribution	543	575	1,080
Total	1,065	1,290	3,864

[1] For exchange rates, see table 1.
Source: Electricite de France.

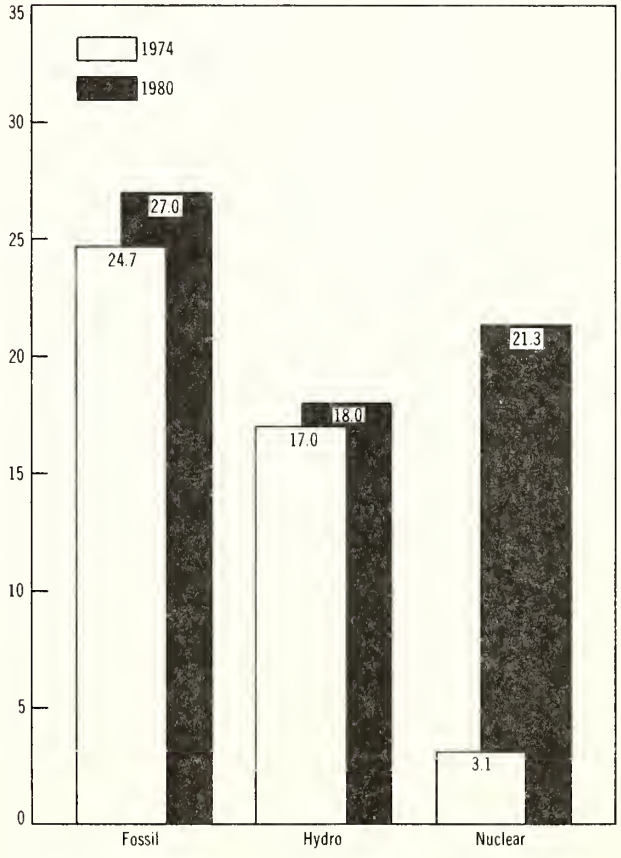
and nuclear generating plants and nine for hydro. Transmission is handled by seven regional entities, which are also responsible for telemetering and other aspects of network control. The transfer of energy between regions is controlled from five centers.

EDF has plans to make nuclear power its primary energy source over the next 10 years. Fossil fuel and hydro generation, which provided over 90% of the nation's 1974 generating capacity, will receive only modest increases. Rising fuel oil costs and the near exhaustion of France's coal potential have prompted this shift; EDF plans to bring nuclear capacity from 3.1 GW in 1974 to 21.3 GW (from 7 to 32% of the total) by 1980 (see figure 2). Nuclear power stations are scheduled to supply 50 GW by 1985.

France's first nuclear power plant, an 85-MW, gas-cooled graphite reactor, began full operations in 1960, and by 1973 seven more plants of this type had been completed, with a total capacity of 2,898 MW. Reactors using enriched uranium and pressurized water were introduced in 1974, and

Figure 2.—France: Electric utility generating capacity, 1974 and projected 1980

(in gigawatts)



Source: Electricite de France statistics.

Table 5.—France: Current and planned construction/ expansion of electrical power plants, 1974-79 [1]

Type	Number of units added	Total generating capacity added (MW)
Nuclear [2]	8	5,940
Fossil	9	4,660
Hydro	31	2,647
Gas turbine	2	100
Internal combustion	1	11
Total	51	13,358

[1] A detailed breakdown of individual construction projects giving such information as names of contracting engineers, starting and expected completion dates, costs, etc., can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] To 1978.

Source: Bureau of International Commerce, Office of International Marketing research study.

eight units of this type are scheduled to reach operation during the 1974-79 period, totaling 5,940-MW generating capacity (see table 5). Pressurized water reactors included in power plant construction plans through 1985 will provide a further 46,900 MW. Other types of reactors used in France include fast breeder reactors; these have been scheduled for three power stations, the last of which (Creys, with 1,200 MW) is slated for completion in 1980. Trade sources regard the fast breeder reactor stations as experimental. There are no further plans to use gas-cooled graphite reactors; the last unit of this type began operations in 1973.

EDF's equipment budget for the remainder of the decade reflects its shift to nuclear technology. Steam turbine generator sets and nuclear reactors will be the major purchase items, with spending forecast to reach $900 million for steam turbines in 1979 and $400 million for reactors (see table 6). Expenditures for conventional power boilers and hydraulic turbine generator sets should decline. Although little demand is anticipated in the utility sector for mobile and portable generating equipment, EDF has been experimenting with peak breaking gas turbine sets and currently owns two small sets. So far, however, the utility has preferred to eliminate peaks by other methods.

This sector's spending for transmission and distribution equipment is forecast to reach $634 million in 1979, more than double the level of these expenditures in 1974. Transformers and switchgear, mainly for use in nuclear power stations, will account for most of the increase. Purchases of transformers are expected to total $365 million in 1979, with large power and secondary unit substation transformers the principal items. Demand for switchgear is forecast to increase to $250 million in 1979. New transmission lines will also be needed for the

Table 6.—France: Estimated equipment expenditures by electric utilities, 1972-75 and 1979
(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	60.0	50.0	50.0	40.0	20
Nuclear reactors	40.0	60.0	100.0	200.0	400
Turbine generator sets					
Steam	100.0	120.0	200.0	500.0	900
Gas	—	—	—	—	—
Hydraulic	50.0	50.0	60.0	50.0	30
Diesel motor generator sets	15.0	15.0	15.0	15.0	15
Total	265.0	295.0	425.0	805.0	1,365
Transmission and distribution equipment					
Distribution transformers	40.0	50.0	60.0	70.0	80
Small power transformers	20.0	22.0	26.0	30.0	35
Secondary unit substation transformers	30.0	35.0	40.0	60.0	100
Large power transformers	40.0	45.0	60.0	100.0	150
Power regulators and boosters	—	—	—	—	—
Switchgear	80.0	80.0	100.0	130.0	250
Power circuit breakers	6.0	7.0	8.0	10.0	15
Control circuit relays	1.5	1.5	2.0	3.0	4
Total	217.5	240.5	296.0	403.0	634
Grand Total	482.5	535.5	721.0	1,208.0	1,999

[1] For exchange rates, see table 1.
Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official French statistics and trade source estimates.

nuclear stations, as most will be located in remote areas.

Sales opportunities in the utility sector for U.S. suppliers will center on nuclear power equipment. Trade sources anticipate markets for highly specialized and technically advanced U.S.-origin equipment and instrumentation.

Industrial end users.—Industrial spending for electrical power equipment totaled $70 million in 1975 or about 5% of the market. Demand from this sector is forecast to increase modestly, bringing purchases to $80 million in 1979. Generation equipment normally represents about two-thirds of sales to this sector.

Several industries generate energy for their own needs; these include the nationalized railways (Societe Nationale de Chemin de Fer—SNCF) and coal mines (Charbonnage de France—CDF), refineries and large-scale metal, chemical and paper factories. Some industrial end users sell surplus power to EDF by means of paralleling into the grid. Notable among them are the SNCF and CDF, both of which have recently built new power stations, and the refineries. Industrial generating capacity totaled 7.4 GW in 1973, the majority of which was provided by conventional fossil fuel steam methods. During 1973, industrial plants added 498 MW to their thermal facilities and 112 MW to hydro capacity.

Industrial end users also constitute a market for emergency generating equipment, primarily diesel-driven units. These units are used mainly in hospitals and computer centers. Mobile and portable units are also purchased, generally by industries located outside the national power supply.

Purchases of transmission and distribution equipment are made mainly by industries operating their own generating plants. Firms taking high tension supply from EDF also need this equipment. Trade sources estimate that they constitute about a third of the market for distribution transformers. Industry's purchases of transmission and distribution equipment are expected to increase from $24 million in 1975 to $30 million in 1979.

Opportunities for sales of U.S.-origin equipment to this sector are centered on American companies manufacturing in France. Many of the factories established by large American multinational corporations are designed on U.S. models and so require American-made generating systems.

Original equipment manufacturers (OEM).—Total sales of parts and components to domestic

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on France is available on a continuing basis from:

Country Marketing Manager—France
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 551-4650

The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: France," DIB 76-04-514, June 1975.

power equipment manufacturers were valued at almost $130 million in 1979 and are expected to rise to $210 million by 1979.

Subassemblies are purchased by domestic manufacturers of gas turbines, diesel engines, alternators, and switchgear. Automatic control components, instruments, and governors are bought by local turbine and generator manufacturers. Original equipment manufacturers do not usually purchase mobile and portable generation equipment items, but manufacturers of pumping and mechanical handling equipment require them.

Most OEM purchases of power equipment from U.S. suppliers are made by the licensees or subsidiaries of American manufacturers. Both of the important French manufacturers of nuclear reactors have licensing arrangements with U.S. companies, opening the door for considerable sales by U.S. suppliers of peripheral nuclear equipment and specialized components.

Government (other than utilities).—A small market, about 1% of the total, is provided by the government sector (excluding local government authorities), mainly by the national telephone, postal, and defense services. Demand for electrical power equipment in this sector grew steadily during 1972-75, with purchases totaling $17.5 million in 1975; expenditures should expand to $21 million in 1979. Generation equipment accounts for over 60% of the sector's purchases.

Advanced Technology/Alternative Sources of Energy

France is receptive to technological change in the energy field and is expected to maintain an active interest in alternative energy sources. A small experimental solar station has been established near Grenoble; it is primarily a research operation and does not presently have any commercial prospects. Although trade sources anticipate growing interest in geothermal energy, this field generally is considered only in a long-term view of the energy situation. In such fields as magnetohydrodynamics, fuel cells, combined cycle power systems, and total energy systems, French utility officials and the scientific community are keeping apace of world developments but are not in the forefront of research activities.

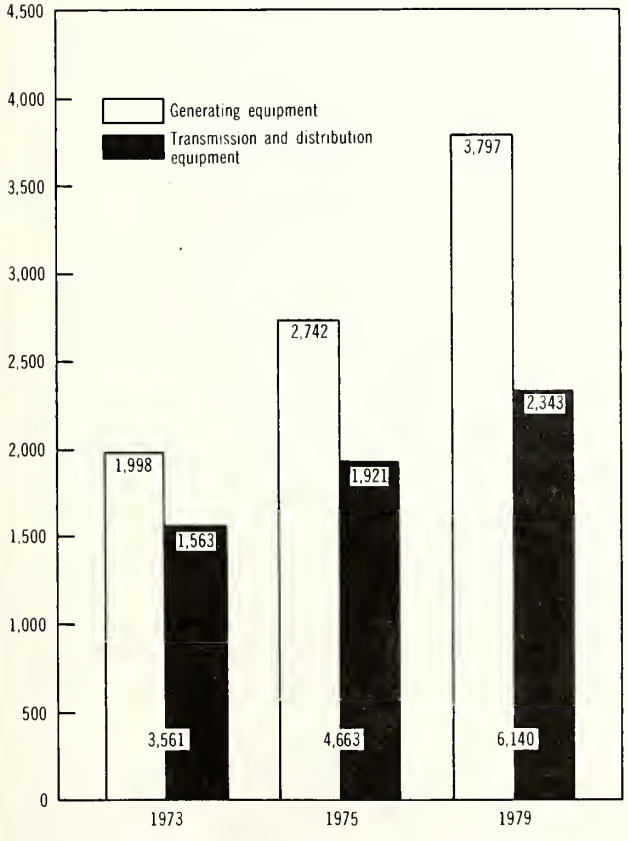
Electrical Energy Systems
Germany

Germany is Europe's largest market for electrical generation, transmission and distribution equipment. Total sales grew from $2.72 billion in 1972 to $4.66 billion in 1975, and forecasts place 1979 expenditures at over $6 billion (see table 1 and figure 1). Almost all of this equipment is produced by local manufacturers.

The most significant purchasers of electrical energy systems are the public utilities; their share of 1972 equipment expenditures was 90%, and is expected to be 93% in 1979. This sector includes not only public generation but also many major industrial companies and the railways, which sell power to the national grid from their own power stations.

Figure 1.—Germany: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Vereinigung Deutscher Elektrizitatswerke; and Bureau of International Commerce, Office of International Marketing research study.

Competitive Environment

Domestic production presently satisfies approximately 99% of Germany's electrical power equipment requirements, and this situation is expected to remain unchanged through the next several years. Manufacturers located in Switzerland, the Netherlands, and France provide the major portion of Germany's electrical energy systems imports (see table 2).

Imports.—Imports of electrical power equipment are growing only slightly. The total value of imported energy systems was $43.5 million in 1973, $46.5 million in 1974, and projections place it at almost $47 million in 1979 (see table 3). Transmission and distribution equipment comprised approximately 87% of total electrical power systems imports in 1974; generation equipment imports, however, are expected to gradually gain relative value, growing from 13% to 15% of the import market in the 1974-79 period.

U.S.-manufactured products have traditionally accounted for only a small share of Germany's total electrical energy systems imports; sales are almost entirely confined to special equipment for which there is no German equivalent. Some items of U.S.-manufactured electrical power equipment which may attract German end users are:

- Rotary soot blowers of the steam jet type
- Boiler accessories, notably advanced water level indicators

Table 1.—Germany: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment ..	1,350	1,800	2,300	2,500	3,500
Transmission and distribution equipment ..	1,100	1,464	1,600	1,800	2,200
Total	2,450	3,264	3,900	4,300	5,700
Industrial companies					
Generation equipment ..	170	180	200	220	270
Transmission and distribution equipment ..	80	90	100	110	130
Total	250	270	300	330	400
Government (other than utilities)					
Generation equipment ..	17	18	20	22	27
Transmission and distribution equipment ..	8	9	10	11	13
Total	25	27	30	33	40
Grand total	2,725	3,561	4,230	4,663	6,140

[1] All figures converted at the following rates: 1972—US$1=DM 3.19; 1973—US$1=DM 2.67; 1974 and thereafter—US$1=DM 2.65.

Source: Vereinigung Deutscher Elektrizitatswerke; and Bureau of International Commerce, Office of International Marketing research study.

- Conveyors incorporating advanced features for quiet operation and reliability
- Cathodic protection systems
- High-accuracy dynamic balancing equipment
- Dual-fuel and multifuel engines with low pollution exhausts
- Advanced filters for oil, water, and air, to be used on engines
- Sophisticated valves for high corrosion application
- High-efficiency insulation and heat recovery systems for steam users
- Radiation detection and monitoring instruments
- Leak detection equipment.

Current trends point to increased use of computer-controlled supervisory equipment. Sophisticated control centers with microwave transmitters and receivers also offer potential sales to American manufacturers. Such equipment could be employed for the telemetering of water in reservoirs, for the measurement of load at various points, and for other delicate monitoring purposes.

Most third-country manufacturers have entered the German market through local subsidiaries. Among these are: Telemecanique, a French company, selling switches and motor control components; the Swedish firm, ASEA, which conducts operations through its German subsidiary, Lepper-Dominit and holds nearly one-third of the German market for distribution transformers; and Kraus & Naimer of Austria, a market leader for cam switches.

Trade and technical regulations.—Germany, of course, is a charter member of the European Economic Community, and, as such, gives tariff preference to all other member countries. Duties applicable to U.S.-manufactured electrical power products range from 5% on some engines, turbines, and machinery to 10% on nuclear reactors. There are no nontariff barriers or other taxes on foreign-made electical power equipment.

German technical standards, known as DIN Standards, are comprehensive and exacting. They are written by the Association of German Electrical Engineers (VDE) and published by the German Standards Committee (DNA)[1]. Conformance to these comprehensive standards, although not legally mandatory, is nonetheless commercially necessary. This includes drawings and specifications, for which standards also exist. All equipment, diagrams and printed material should use German symbols.

Domestic production.—Total value of electrical energy systems production in Germany was $4.2 billion in 1974 and is expected to reach $6 billion in 1979, which includes sizable world-wide exports. Because of the close relationship between key manufacturers and public utilities, heavy power equipment and small products required in large volume are nearly always purchased from three select firms. The "big three" of the German electrical equipment industry are Siemens-Schuckutwerke, A.G.; Allgemeine Elektricitats Gesellschaft-Telefunkens (AEG); and Brown-Boveri & Cie, AG (an affiliate of the Swiss company of the same name). Through the various channels of the Central Association of the Electric-Technical Industry (ZVEI), the principal trade association, an orderly arrangement prevails whereby the whole electrical equipment industry operates on one common plan. The three large companies maintain international sales forces which bring in sizable projects to Germany, and the orders are shared. They buy from each other and from other German specialists. This pattern is a traditional one that is likely to be maintained.

The prominent Kraftwerke Union (KWU) presently holds 90% of the market for nuclear reactors; its sales account for 70% of all turboalternators sold in Germany. KWU is a new, vital entity founded and financed 50% by Siemens and 50% by AEG. When

[1] The electrical power supply throughout Germany follows a system of 380 volts, 3-phase, 50 hertz, with the attendant 220 volt, single-phase supply. Double insulation, rather than grounding is normally used. The metric system of weights and measures is the statutory standard throughout the country. Publications concerning German standards for electrical energy systems may be obtained from Deutscher Normenausschus (German Standards Committee) at either 1 Berlin 30, Berggasafenstrasse 4-7, Germany; or 5 Koln, Kemekestrasse 2-8, Germany.

Table 2.—Germany: Major suppliers of electrical power equipment

Domestic manufacturers

M.A.N.
Steam boilers

Kraftwerke Union
Nuclear reactors, turboalternators

Transformatoren Union
Transformers

Siemens
Switchgear, generation equipment

AEG
Switchgear, generation equipment

Calor-Emag (73% owned by Brown-Boveri)
Switchgear

Concordia Sprecher (50% owned by Sprecher & Schuh, Switzerland)
Switchgear

Brown-Boveri & Cie, A.G. (affiliated with Brown-Boveri & Cie., Switzerland)
Transformers, nuclear reactors, turboalternators

Lepper-Dominit (subsidiary of ASEA, Sweden)
Transformers

United States manufacturers

General Electric
Motor control components, other panel components

Westinghouse
Motor control components, other panel components

Square D
Motor control components, other panel components

CutlerHammer
Motor control components, other panel components

Allen-Bradley
Motor control components, other panel components

Third-country manufacturers

Telemechanique (France)
Switches, motor control components, other panel components

ASEA (Sweden)
Transformers, motor control components, other panel components

Hazemeyer (Netherlands)
Load switches, plastic control gear boxes

Smit Transformatoren (Netherlands)
Transformers

Vynckier Freres (Belgium)
Load switches, plastic control gear boxes

Pauwels (Belgium)
Transformers

Elin (Austria)
Transformers

Italtrafo (Italy)
Transformers

Fantani Cosmi (Italy)
Pushbutton starters

Kraus & Naimer (Austria)
Cam switches

Source: Bureau of International Commerce, Office of International Marketing research study.

technical difficulties arose at several stations in 1974, it became necessary for AEG to pay KWU more than $250 million to put the troubled stations in order. AEG had to mortgage factories to pay its debts to KWU. The German Government might ultimately have to provide heavy financial assistance to bolster AEG and thus make KWU an even more successful nuclear power station builder.

KWU charges exceptionally high prices for nuclear equipment, due in part to costly safety requirements for German-made reactors. Some trade experts believe that American manufacturers, with their advanced nuclear technology and ability to satisfy strict German safety requirements, can successfully participate in the market for nuclear power plants in Germany.

A great deal of subcontracting takes place in the German electrical energy systems market. Some companies fabricate no more than 30% of their products in their own factories, subcontracting for the remaining 70%. Required components are nearly always purchased domestically.

End Users

Electric utilities.—Electric power in Germany is generated by three sources: the public electric utility companies, industrial suppliers, and the railways. Public utilities provide by far the bulk of the country's electric power. Each company is a member of the Association of German Electricity Producers (VDEW).

German municipalities previously generated all necessary power themselves, but gradually the national authorities have taken over the task. Eight such authorities contribute 80% of the total public supply, of which one, Rheinisch Westfalisches Elektrizitatswerk AG (RWE), administers 30% of the installed capacity of the country. The most important subsidiary of RWE is Rheinische Braunkohlarwerke AG of Cologne, a massive lignite mining company with $100 million in capital. The trend is clearly toward these eight authorities increasing their share of responsibility for electric power provision and completely dominating the purchase of generation

Table 3.—Germany: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in millions of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	1.1	1.3	1.5
Switzerland	.2	.2	.2
Netherlands	.1	.1	.2
France	3.0	3.0	3.5
All others	1.6	1.6	1.9
Subtotal	6.0	6.2	7.3
Transmission and distribution equipment			
United States	1.2	1.3	1.5
Switzerland	13.2	14.0	12.0
Netherlands	11.1	12.5	12.0
France	7.3	7.5	8.0
All others	4.7	5.0	6.0
Subtotal	37.5	40.3	39.5
Totals			
United States	2.3	2.6	3.0
Switzerland	13.4	14.2	12.2
Netherlands	11.2	12.6	12.2
France	10.3	10.5	11.5
All others	6.3	6.6	7.9
Grand total	43.5	46.5	46.8

[1] For exchange rates, see table 1.

Source: Statistisches Bundesamt; and Bureau of International Commerce, Office of International Marketing research study.

equipment and transmission systems. Hundreds of other VDEW members, which buy equipment at the prevailing system voltage, dominate the purchase of distribution equipment.

The central planning and coordinating organizations of Germany's electrical energy systems are located at Frankfurt. They are: VDEW, ZVEI, and VDE.

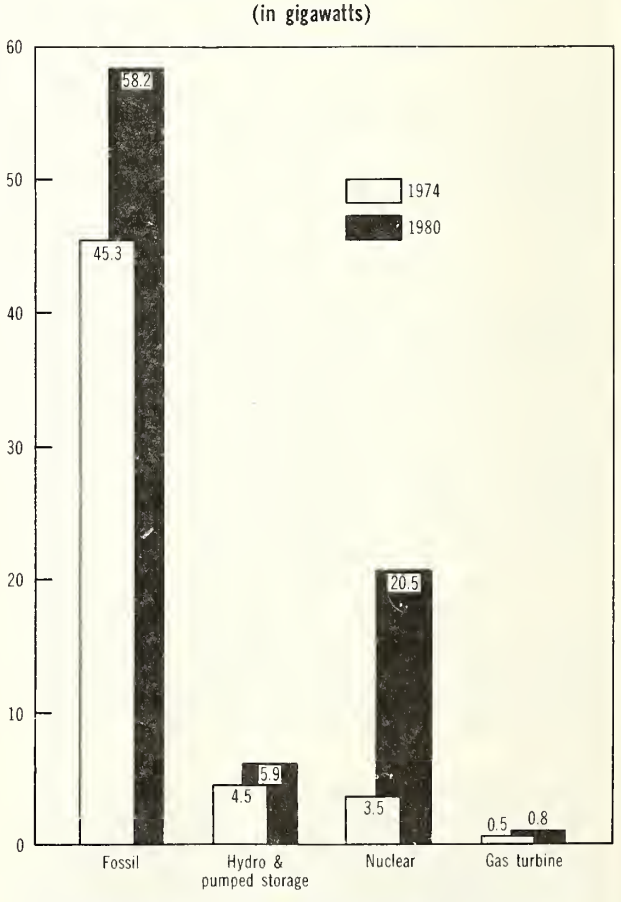
The generating capacity of German electric utilities is projected to increase from a total of 53,800 MW in 1974 to 85,400 MW in 1980 (see figure 2). The addition of 52 new generating units is planned during the period from 1975 through 1979 (see table 4); approximately 62% of these new units will utilize fossil fuels, 27% nuclear energy, and 11%, hydroelectric energy. The most dramatic increase in generating capacity will be in the use of nuclear energy, with 13,465 MW nuclear-source capacity planned for 1979. KWU has contracted to be the primary reactor/turbine and generator supplier. Seven of the 14 new nuclear units are to be mobilized by pressurized water, five by boiling water. The Hochtemperatur-Kernkraftwerk GmbH plant at Uentrop will be operated by high-temperature, gas-cooled nuclear energy; and the Schnell-Bruter Kernkraftwerksgesellschaft GmbH plant at Kalkar will be a fast breeder reactor station.

KWU and Brown-Boveri have developed standard power station packages which facilitate planning and reduce costs. The complete packages include not only station design and construction, but financial arrangements as well, and they are sold both in Germany and abroad.

Difficulty in obtaining approval for sites could force the program to be cut back. There has also been considerable opposition to the use of nuclear energy from local and foreign environmentalists, sometimes necessitating redesign of equipment and heavy expenditure on additional safety features by German manufacturers. Public hostility to the nuclear stations could cause delays which will eventually escalate costs.

According to present plans, electric utilities expenditure should rise from $3.9 billion in 1975 to $5.7 billion in 1979. Spending on nuclear reactors is projected to increase from $1.15 billion in 1975 to $1.8 billion in 1979 (see table 5). Electric utilities' purchases of steam generator sets are expected to reach $1.4 billion in 1979, representing a 40% advance from 1975 expenditures. Although conservative growth projections have been made for large

Figure 2.—Germany: Electric utility generating capacity, 1974 and projected 1980



Source: Vereinigung Deutscher Elektrizitatswerke, Elektrizitat 1974; and Bureau of International Commerce, Office of International Marketing research study.

Table 4.—Germany: Current and planned construction/ expansion of electric power plants, 1975-80 [1]

Type	Number of units added	Total generating capacity added (MW)
Hard coal	2	1,380
Lignite	5	3,000
Fuel oil	13	5,504
Natural gas	12	5,515
Hydro	6	1,400
Nuclear	14	13,465

[1] A detailed breakdown of individual construction projects, giving such information as name of contracting engineers, starting and expected completion date, costs, etc. can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

Source: Vereinigung Deutscher Elektrizitatswerke; and Bureau of International Commerce, Office of International Marketing research study.

Table 5.—Germany: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	400	450	400	300	250
Nuclear reactors	400	600	950	1,150	1,800
Turbine generator sets					
Steam	500	700	900	1,000	1,400
Hydraulic	50	50	50	50	50
Total	1,350	1,800	2,300	2,500	3,500
Transmission and distribution equipment					
Distribution transformers	290	320	330	350	400
Small power transformers	20	22	25	28	40
Secondary unit substation transformers	150	235	252	275	350
Large power transformers	250	445	450	500	650
Power regulators and boosters	10	10	10	10	10
Switchgear	350	400	500	600	700
Power circuit breakers	25	26	27	30	40
Control circuit relays	5	6	6	7	10
Total	1,100	1,464	1,600	1,800	2,200
Grand total	2,450	3,264	3,900	4,300	5,700

[1] For exchange rates, see table 1.

Source: Vereinigung Deutscher Elektrizitatswerke; and Bureau of International Commerce, Office of Interational Marketing research study.

power transformers and switchgear, about one-third of the $2.2 billion electric utilities' transmission and distribution expenditure is predicted to be spent on each of these categories of equipment. Spending on both small power transformers and control circuit relays is expected to increase about 9% annually in the 1975-79 period.

Industrial end users.—Sales of electrical power equipment to industrial end users increased from $250 million in 1972 to $330 million in 1975. Projections for 1979 place the electrical industry's purchases at $400 million. Expenditure on generation equipment is roughly twice as large as that on transmission and distribution equipment.

In order to move quickly in the early postwar years, Germany's railways and industries installed their own relatively small power stations. Although still operating, the contribution of electric power generated by German railways and industries to the total national electric power supply has become dwarfed by the massive increases made by public generating companies.

A generous allowance to private industry by the Government to induce electrical energy systems investment is expected to encourage installation of some peak-breaking units. There may be scope for sales of these units—both diesel and gas-turbine—by American manufacturers.

Government agencies.—Expenditure for generation, transmission, and distribution equipment by government agencies other than utilities reached about $33 million in 1975 and is projected to approach $40 million in 1979. This sector is the least likely to buy imported electrical power equipment.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on Germany is available on a continuing basis from:

Country Marketing Manager-Germany
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electric Energy Systems: Germany." DIB 76-02-506, August 1975.

Advanced Technology/Alternative Sources of Energy

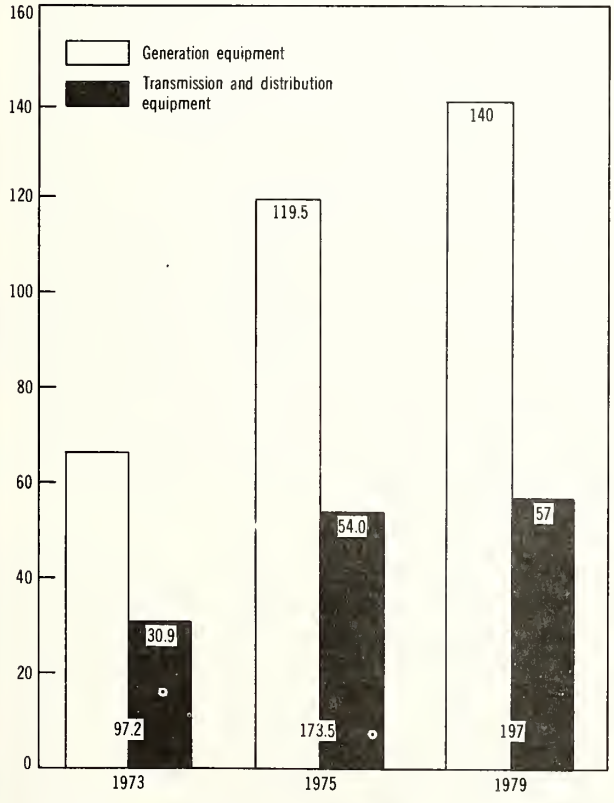
KWU is the only organization conducting research on new energy sources. Of the several alternative energy sources discussed in their most recent annual report, only silicon solar cells and orbiting solar power stations are considered even remote possibilities.

As discussed earlier, computer controlled supervisory equipment will come into greater use in Germany. Another area of future growth should be coal gasification, which would be a boon to a country which generated about one-third of its electrical energy from this fuel. Nuclear heating is used in the demonstrators already in operation.

Electrical Energy Systems
Indonesia

Major purchases by industry and government pushed the market for electrical generation, transmission and distribution equipment in Indonesia from $32 million in 1972 to almost $175 million in 1975 (see table 1). Per capita consumption of electrical power in Indonesia has been among the lowest in the world—an estimated 3% of the population and just over 30% of the industrial enterprises were provided with electric service as of the early 1970's. However, the Government is making an effort to meet the burgeoning demand for electricity through its public utility, the Perusahaan Listrik Negara (PLN), under its Second Five-Year Plan (1974-79). Indonesian expenditures for electrical power generation, transmission and distribution equipment in 1979 are projected to approach $200 million, of which PLN is expected to account for almost half.

Figure 1.—Indonesia: Total sales of electrical power equipment, 1973, 1975, and projected 1979 (in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Perusahaan Listrik Negara (PLN) and Bureau of International Commerce, Office of International Marketing research study.

Generation equipment represents the largest and fastest growing segment of the market (see figure 1). Most major industrial enterprises in Indonesia maintain captive generating equipment; many are entirely self-sufficient, while others use their equipment to supplement utility-supplied power during periods of inadequate supply or failure. Total purchases of generation equipment are expected to reach approximately $140 million in 1979, while sales of transmission and distribution equipment are projected at $57 million in the same year.

Manufacturers in the United States supplied electrical energy equipment to Indonesia valued at more than $40 million in 1974, almost double the 1973 U.S. sales figure. They are projected to increase their sales to more than $46 million in 1979. Most U.S.-origin electrical power equipment bought in Indonesia is for generation of electricity, and its prime consumers are industrial end users.

During the current Five-Year Plan, PLN is expected to focus on the installation of generating units that require a relatively short construction period, and so PLN purchases over the next few years are forecast to be concentrated on thermal units, steam stations, gas turbines, and diesel stations. However, some PLN construction of major hydroelectric and microhydroelectric power plants is also planned during this period. At the same time, considerable purchases of switchgear and related

Table 1.—Indonesia: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	5.9	9.0	11.6	44.7	63
Transmission and distribution equipment	7.6	11.7	12.2	29.0	32
Total	13.5	20.7	23.8	73.7	95
Industrial companies					
Generation equipment	6.8	29.9	52.7	40.4	42
Transmission and distribution equipment	2.7	9.9	16.2	13.5	14
Total	9.5	39.8	68.9	53.9	56
Government (other than utilities)					
Generation equipment	6.8	27.4	45.8	34.4	35
Transmission and distribution equipment	2.3	9.3	15.3	11.5	11
Total	9.1	36.7	61.1	45.9	46
Grand Total	32.1	97.2	153.8	173.5	197

[1] All figures converted at the following rates: 1972—US$1=Rp 415; 1973—US$1=Rp 415; 1974—US$1=Rp 421; 1975 and thereafter—US$1=Rp 428.

Source: PLN, and Bureau of International Commerce, Office of International Marketing research study.

transmission and distribution equipment are expected to be required for use in PLN's planned construction of 1,900 kilometers (km) of 150-kV lines, 1,600 km of 70-kV lines, and 180 km of 30-kV lines. Strong demand will continue in the private sector for diesel and gas turbine power plants.

Electrical power equipment with the highest sales potential in Indonesia includes: diesel engine power plants and generator sets with capacities from 50 kW to 1,500 kW; gas turbine generator sets in the 1,000-kW to 20,000-kW range; steam power plants with capacities from 10 MW to 100 MW; hydroelectric turbines above 50 MW; transmission and distribution equipment for 30-kV, 70-kV, and 150-kV lines; equipment for substations of up to 2,500-MVA capacity; and microhydroelectric generating equipment in the 20-kVA to 200-kVA range.

Despite the current emphasis on construction of power plants fueled by oil in Indonesia and the large reserves of high-quality oil available in the country, efforts by PLN to substitute natural gas and coal for petroleum are underway. Indonesia plans to construct more hydropower plants, coal-fired steam power stations, geothermal power stations, and, eventually, nuclear power plants. Generating equipment capable of conversion to natural gas, coal, or oil is expected to be emphasized in the future.

Competitive Environment

Imports supply virtually the entire market for electrical generation, transmission, and distribution equipment in Indonesia. Only limited quantities of transformers and power cables, are produced locally. Although several domestic companies plan to produce switchgear, and one joint venture enterprise plans to manufacture electric motors and generators, local production is expected to remain relatively insignificant for the foreseeable future. The market for imported parts and components is expected to average less than $100,000 per year through this decade. (Table 2 lists small domestic manufacturers along with major foreign firms and equipment they supply to Indonesia.)

U.S. manufacturers' share of the total Indonesian electrical energy equipment market rose from 21% in 1973 to 26% in 1974. This increase was attributable to both the U.S. Government financing of electrical power projects and the demands of American oil exploration companies that tend to purchase U.S. equipment.

As shown in table 3, sales of generation equipment made by firms in the United States rose from $17.5 million in 1973 (23% of the total import market for such equipment) to $33.4 million (28%) in 1974; they are expected to increase slightly over the next few years, to total $34 million (25%) in 1979. U.S. sales of transmission and distribution equipment jumped from $3.1 million in 1973 (16% of that import market) to $7.1 million (21%) in 1974; they are projected to exceed $12 million (20%) in 1979.

American-made electrical energy equipment has an excellent reputation for reliability and durability in Indonesia, and product support activities are good. American equipment is usually price competitive, but conformity to National Electrical Manufacturers Associations standards, which are generally stricter than European standards, may result in higher pricing. While PLN tends to prefer European transmission and distribution equipment because of voltage and frequency compatibilities, American equipment is widely purchased for the large PLN transmission/distribution projects in which U.S. firms participate. Credit availability is a basic key to expanding sales. Interest on loans in Indonesia is high and cash funds generally unavailable.

Third-country suppliers have a strong and growing position in the electrical energy systems equipment market in Indonesia. Manufacturers in Japan provided 24% of the total market in 1974; as a result of aggressive government and private financing of large projects, that share is expected to increase to 30% by 1979. Japanese suppliers have proved particularly adept to putting together highly competitve package proposals through the use of consortia, which include suppliers of all types of equipment, services, and financing. Furthermore, European- and Japanese-origin switchgear, transformers, and other distribution and transmission equipment tend to be

Table 2.—Indonesia: Major suppliers of electrical power equipment

Domestic manufacturers

P. T. Icesa
Panelboard assembly from imported components

P. T. Sucaco
Power and telecommunications cables

P. T. Kabelindo
Power and telecommunications cables

P. T. Unindo (joint venture between PLN and C.G.E., France)
Power transformers, metal-clad switching cubicles for transformer substations; plans to produce switchgear

P. T. Bina Electro (license of AEG, Germany)
Motor switches and control panels; plans to produce switchgear

P. T. Eltab (joint venture with Eltab Company, Ceylon, a GEC licensee)
Plans to produce electric motors and generators

United States manufacturers

General Electric
Oil-fired steam generating power plants, gas turbine power plants, switchgear, transformers, and other electric equipment

Westinghouse Electric
Oil-fired steam generating power plants, gas turbine power plants, transformers, switchgear, and other electric equipment

International Harvester Co., SOLAR Division
Gas turbines (60 kW to 2,500 kW)

Dresser Industries, Waukesha Engine Division
Diesel generator sets (60 kW to 1,350 kW) and control systems

Babcock & Wilcox
Power boilers

Square D Company
Switchgear and control panels

Caterpillar Tractor Co., Industrial Division
Diesel generator sets (63 kW to 1,118 kW)

Foster Wheeler World Services Corporation
Power boilers

Allis Chalmers
Turbine generators

General Motors Corporation, Electro-Motive Division
Diesel generator sets (700 kW to 1.800 kW)

General Motors Corporation, Detroit Diesel Allison Division
Diesel power plants and diesel generator sets (25 kW to 935 kW)

DeLaval Turbine Inc., Enterprise Engine & Compressor Division
Diesel power plants (2,160 kW to 10,435 kW)

Onan Corporation
Diesel generator sets (up to 500 kW) and automatic transfer switches

Third-country manufacturers

Algemeine Electricitate Gesellschaft (Germany)
Turbine generators, distribution and transmission equipment

Mitsubishi Corp. (Japan)
Diesel power plants, turbine generators, complete steam power plants, electrical equipment

Siemens (Germany)
Turbines, transformers, switchgear, and other generation, transmission, and distribution equipment

Hitachi Ltd. (Japan)
Gas turbines

Sumitomo S.K. (Japan)
Transmission and distribution equipment, steam power plants

Alsthom (France)
Diesel generator sets, oil-fired steam power plants, transformers, switchgear, and other electrical equipment

ASEA (Sweden)
Power transformers, complete electrical systems

John Brown Engineering Ltd. (United Kingdom)
Gas turbines

Westinghouse of Canada (affiliate of U.S. firm, Canada)
Gas turbines

Elin Union A.G. (Austria)
Power transformers, turbine generators

Perkins Engines Ltd. (United Kingdom)
Diesel power plants

Klochner-Humboldt Deutz AG (Germany)
Diesel power plants and generator sets

Kraftwerk-Union (Germany)
Power boilers, turbine generators, power transformers, and other electric equipment

Temeg (member of Merlin Gerin Group, France)
Circuit breakers and relays

Stork-Werkspoor Diesel B.V. (Netherlands)
Diesel power plants, power boilers

Motoren-Werke Mannheim AG (Germany)
Diesel power plants

Nuovo Pignone S.p.A. (Italy)
Diesel and gas turbine power plants

Kongsberg Vapenfabrikk Norway A/S (affiliate of North American Turbine Corp., Norway)
Gas turbines

Ruston Gas Turbines Ltd. (United Kingdom)
Gas turbines

Mirrlees Blackstone Ltd. (United Kingdom)
Diesel power plants

Source: Bureau of International Commerce, Office of International Marketing research study.

Table 3.—Indonesia: Estimated imports of electrical power equipment, 1973, 1974, and 1979
(in millions of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	17.5	33.4	34
Japan	19.1	27.3	41
Germany	14.8	29.1	27
All others	26.2	29.9	34
Subtotal	77.6	119.7	136
Transmission and distribution equipment			
United States	3.1	7.1	12
Japan	4.7	8.8	18
Germany	3.8	5.4	9
All others	7.9	12.8	22
Subtotal	19.5	34.1	61
Totals			
United States	20.6	40.5	46
Japan	23.8	36.1	59
Germany	18.6	34.5	37
All others	34.1	42.7	55
Grand Total	97.1	153.8	197

[1] For exchange rates, see table 1.
Source: Indonesian Central Bureau of Statistics, and Bureau of International Commerce, Office of International Marketing research study.

cheaper than U.S.-made equipment while their overall quality is good.

Firms in Germany supplied over 22% of the total Indonesian market for electrical energy equipment in 1974; their share is predicted to drop to 18% in 1979. Financing of major projects by France is forecast to increase the share of the market supplied by French firms from 5% in 1974 to almost 11% in 1979. The proportion of the market satisfied by manufacturers in the Netherlands is predicted to rise from 2 to 5% between 1974 and 1979, while the share of U.K. suppliers is predicted to fall from 5 to 3% during the same period.

Trade and Technical Regulations.—Customs duties on most imported electrical power generation, transmission and distribution equipment range between 10 and 30%, but some rates are as high as 60%. A 5 to 10% sales tax is also imposed on the sum of the c.i.f. value, all customs levies, and a 5% importer's fee. Trade sources caution that Indonesian procedures for importing machinery are complicated, involving much time-consuming paperwork.

Thus far Indonesia does not have technical standards to which electrical power equipment must conform by law or regulation. Most Indonesian executives and engineers are European-educated and therefore more familiar with European technical specifications. Moreover, a Japanese mission for technical cooperation in industry, mining, and power has discussed with PLN officials an offer of technical assistance for establishing a laboratory to develop electrical standards for the country. Meanwhile, trade sources recommend that suppliers be aware of the need to weatherize equipment to withstand Indonesia's hot, humid climate.[1]

Trade Practices.—Indonesia does not yet have consulting firms with expertise in electrical power generation or transmission systems. Consequently, foreign consulting and contracting engineers are widely used in the public power sector in Indonesia. Opportunities for consulting contracts are many in Indonesia. Agencies such as the World Bank and the Asian Development Bank require that consultants make feasibility studies before financing projects and oversee the execution of projects for which loans are granted.

PLN has also engaged foreign consultants to develop and recommend management and accounting procedures, plan systems, forecast electrical power requirements, draw up specifications and conduct the bidding for power plants, and supervise construction. The influence of consultants on purchasing decisions, however, may be limited, since most component purchases are tied to suppliers' credit terms.

End Users

Electric utilities.—Indonesia's single public electric utility, PLN, was officially established in 1965. PLN suffered various organizational difficulties until 1970, when an International Development Association loan enabled a French consulting firm, SOFRELEC, to improve its organization and financial management, accounting methods, and planning and operational procedures. A new charter was issued in 1972 giving the PLN exclusive right and responsibility to generate, transmit, and distribute power throughout Indonesia, to construct and operate power plants and distribution networks, and to supervise non-PLN power activities. The tariff structure was revised and rates instituted to cover not only PLN operating expenditures including depreciation and debt service, but also to create a surplus capital fund for financing further expansion.

PLN is not expected to be able to meet the private sector demand for electricity for many years. In the meantime, private interests are allowed to build and operate generating stations and, in some cases, distribute electricity to consumers in surrounding areas.

As a result of inadequate maintenance and lack of spare parts for diesel generation sets and other facilities, much of PLN's generation capacity is frequently out of service. Moreover, PLN's expansion of its distribution systems has not kept pace with

[1] Electrical power is most often supplied at 127/120 V or 110/190 V, 50 hertz. In some large American oil installations, however, the U.S. standard (115/230 V or 220/440 V, 60 hertz) is employed. Trade sources predict that most equipment supplied to Indonesia eventually will have to conform to the 200 V, 50-hertz standard. The metric system of weights and measures is commonly used in Indonesia, but the British system is also known and used.

improvements in generation and transmission. Java, with the best developed generation and transmission facilities in Indonesia, still has no centralized distribution system; most of the island's distribution systems were constructed 30 to 50 years ago. Outside Java, PLN maintains many small, isolated systems that provide limited generation and distribution service to the main cities and a few towns or villages.

Estimates vary widely with regard to the breakdown of ownership of power generating facilities in Indonesia, but PLN claims that it provided about 42% of the country's electrical power generated in 1974. Other trade sources, however, feel that the utility generated closer to 60% of the total electrical power in 1974. PLN's generating capacity at the end of the First Five-Year Plan in 1973 was estimated at over 900 MW, of which hydropower plants accounted for about 39% and thermal power plants 61%. Its capacity rose to 1,044 MW in 1974 and was estimated to total 1,400 MW in 1975. PLN has ambitious plans for its future growth: it estimates adding 1,000 MW per year. The breakdown in figure 2, however, reflects the more conservative trade source estimate of a 2,432 MW total installed capacity in 1980. The ratio of hydropower plants to thermal power plants at the end of the Second Five-Year Plan in 1979 is expected to be approximately 25% hydro and 75% thermal.

Capital expenditures by PLN, which rose from less than $37 million in 1973 to just over $42 million in 1974, jumped to an estimated $128 million in 1975 (see table 4). Outlays for fossil power generation increased fourfold in 1975, and those for gas turbine power generation, sevenfold. Expenditures for transmission and distribution, while large, showed less spectacular growth.

Electrical power equipment expected to be in demand by PLN during the remainder of the 1970's is outlined in table 5.

Nuclear generation is not used in Indonesia, and

Table 4.—Indonesia: Estimated capital expenditures by electric utilities, 1973, 1974, 1975, and 1980

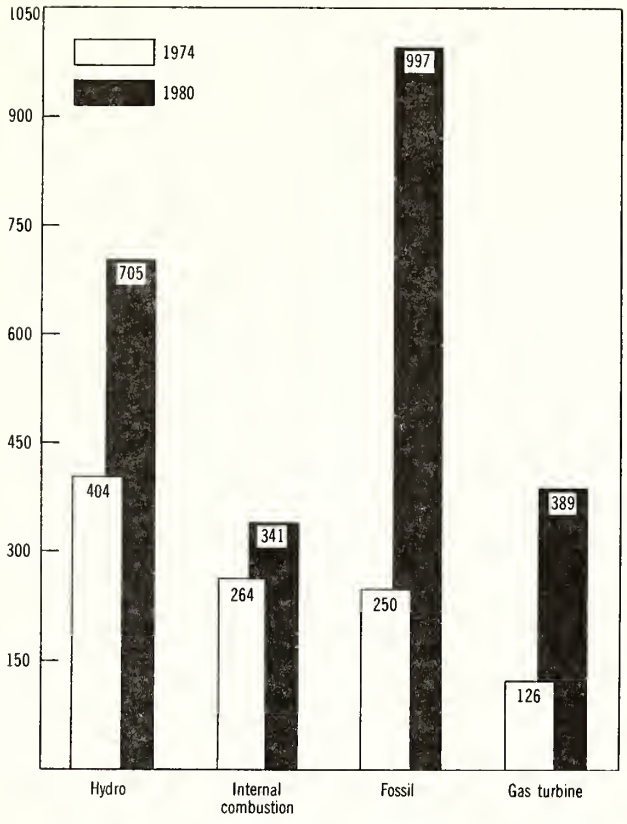
(in millions of U.S. dollars)[1]

	1973	1974	1975	1980
Generation				
Fossil	5.6	7.1	29.1	48
Hydro	3.7	4.8	8.9	15
Gas turbine	2.5	3.3	23.8	40
Internal combustion	3.2	4.1	12.7	21
Total	15.0	19.3	74.5	124
Transmission	5.8	6.3	17.0	23
Distribution	13.7	14.1	31.3	53
Miscellaneous	2.1	2.4	5.5	10
Grand Total	36.6	42.1	128.3	210

[1] For exchange rates, see table 1.

Source: First and Second Five-Year Plans, PLN, and trade source estimates.

Figure 2.—Indonesia: Electric utility generating capacity, 1974 and projected 1980 (in megawatts)



Source: PLN and trade source estimates.

no investment in nuclear reactors is scheduled under the current Five-Year Plan. Nevertheless, a preparatory committee for nuclear power construction established in 1972 by the Ministry of Public Works and Power and the National Atomic Energy Agency expects to have a feasibility study ready in 1977. The committee forecasts that construction on the first nuclear power plant will begin in 1979 or 1980, with completion in 1985 at the earliest. Trade sources speculate that the country's first nuclear establishment will be a 600-MW plant of the heavy water type. Foreign technology will be required both to process the uranium from domestic deposits and to construct the plant.

PLN plans for construction and expansion of power generating plants between 1975 and 1980 are given in table 6. Most of the proposed PLN investments are for projects involving fossil power. The cost of some 150 additional units is estimated at more than $2.4 billion; the total increase in capacity will exceed 4,800 MW. Trade sources predict, how-

Table 5.—Indonesia: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	.8	1.3	1.6	6.7	9
Nuclear reactors	—	—	—	—	15
Turbine generator sets					
Steam	1.4	2.1	2.7	10.7	20
Gas	1.0	1.5	2.0	14.3	8
Hydraulic	1.5	2.2	2.9	5.4	10
Motor generator sets					
Diesel	1.2	1.9	2.4	7.6	1
Total	5.9	9.0	11.6	44.7	63
Transmission and distribution equipment					
Distribution transformers	.9	1.8	1.2	3.5	5
Small power transformers	.3	.5	.6	1.5	2
Secondary unit substation transformers	.2	.5	1.3	2.3	3
Large power transformers	.9	.5	.4	1.7	8
Power regulators and boosters	.8	1.7	1.8	2.4	1
Switchgear	2.9	5.5	5.3	14.4	10
Power circuit breakers	1.0	.7	.7	1.5	1
Control circuit relays	.6	.5	.9	1.7	2
Total	7.6	11.7	12.2	29.0	32
Grand Total	13.5	20.7	23.8	73.7	95

[1] For exchange rates and source, see table 1.

Source: PLN, and Bureau of International Commerce, Office of International Marketing research study.

ever, that many of these projects will be delayed or remain without funds for many years.

Industrial end users.—Private end users were estimated to have had about 30% of Indonesia's total power generating capacity in 1975. Petroleum and mining enterprises are by far the largest private sources of electrical energy.

Oil producers have to provide all power used for their operations including workers' housing. The largest oil producer, Caltex, reportedly uses gas turbine generating facilities with a 250 MW capacity, at its field operations in Sumatra and about 1,000 km of 115-kV lines. In Djakarta, Caltex has eight diesel generating units to operate its offices and a radio station. The company is moving toward total electrification of its operation. Like other oil and mining firms in Indonesia, Caltex donates electrical power equipment to the local communities in which it works.

Each of the country's privately owned steel mills is estimated to employ about five 20-MW gas turbine power plants. The International Nickel Company uses diesel generators of 620-kW and 260-kW capacity during the construction of its Sorako project in Sulawesi, which will ultimately be replaced by a hydroelectric plant. The new Fairchild Semiconductor Company near Djakarta imported five 500-kW diesel generators. A local subsidiary of the Freeport Minerals Company supplied all the electrical power required in its construction of the Freeport Ertsberg Copper concentrate mill; the project began in 1970 with a budget of over $120 million and has spawned a mining town of 1,500 population.

Trade sources report that the Shell Oil company is considering construction of a coal-fired steam power plant at the government-owned Bukit Assam coal mine. As much as 200 MW of generation capacity is expected to be required to produce the desired 25 million tons of coal per year.

The largest logging firm in Indonesia, P. T. Weyerhaeuser, a U.S. subsidiary, generates its own electrical power for its operations in Kalimantan. This facility employs 2,000 workers and involves a sawmill, workshops, hospital, offices and a loading wharf. The company uses five 150-kVA units, plus mobile units for its smaller camps.

Other than the petroleum and mining sectors and possibly the larger lumbering enterprises, most industrial consumers of electricity in Indonesia are not installing major power generating systems for long-term use but are purchasing interim equipment for use until PLN can supply their needs. A variety of manufacturing firms, including textile, food processing, metalworking, and other industries, employ small diesel generator sets ranging between 24 kW and 100 kW. Hotels and office buildings in the large cities also own generator sets for emergency and supplemental power, and many are used extensively.

Investment in electrical energy equipment by industrial end users is expected to remain high throughout the remainder of the 1970's, with industry purchases of generation equipment projected at $42 million and transmission and distribution investment at $14 million in 1979. As PLN expands its service, the proportion of total expenditures for electrical energy equipment in Indonesia accounted for by the industrial sector is expected to fall from 45% in the peak year of 1974 to 29% in 1979.

Government (other than utilities).—Nonutility government end users were estimated to have accounted for about 28% of Indonesia's total electrical power generating capacity in 1974. This sector includes several government departments, such as Defense and Security, Agriculture, and Communications. State-owned enterprises in this sector include the national oil company, Pertamina; rubber, sugar, and palm oil plantations; cement plants; fertilizer plants; a pharmaceutical complex; a logging firm; and three mining companies—P. M. Aneka Tambang for general mining, P. N. Batubara for coal production, and P. N. Timah for tin production.

Pertamina's estimated 1974 electrical generating capacity, including operations at various oil drilling rigs, refineries, and other facilities, exceeded 155 MW, equivalent to 15% of PLN's total potential

Table 6.—Indonesia: Current and planned construction/expansion of electric power plants, 1975-80 [1]

	Number of units added	Generating capacity (MW) added	Total cost [2] (in millions U.S. $)
Hydro	20	248	114
Fossil	82	3,330	1,675
Gas turbine	50	1,235	300
Geothermal	2	60	26

[1] A detailed breakdown of individual construction projects giving such information as names of contracting engineers, starting and expected completion dates, costs, etc., can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] For exchange rates, see table 1.

Source: PLN.

at that time. In addition to controlling the activities of foreign exploration and production companies, Pertamina is involved in many of its own projects, including construction of two liquid natural gas plants, a large rice plantation project, and the P. T. Krakatau Steel Mill. In its four refinery operations, Pertamina uses both steam generators and gas turbines to produce electricity. At Sunei in Sumatra, Pertamina uses five 3-MW General Electric steam generators and one 6-MW Westinghouse steam unit. The Balikpapan refinery on Kalimantan uses a 20-kW steam generator and three 3-MW GEC gas turbines. The Dumai refinery in Sumatra has a Siemens 30-MW steam plant. At Plaju, two 4-MW units and one unit each of 7.2-MW and 9.6-MW capacity are used, and a new Nuovo Pignone 3-MW gas turbine is to be added. The new Pertamina refinery at Cilicap in Central Java will have a Siemens steam plant with a capacity of 20 to 30 MW.

Pertamina also operates a number of offshore drilling units, which require their own generation facilities. In the West Java Sea, eight new 800 KW International Harvester Solar gas turbines were added to the two existing units in 1975.

Uncounted smaller amounts of power generation capacity are provided by individual nonutility government departments or by the government-owned economic enterprises scattered about the country. A government-owned cement plant at Ujung Pandung, South Sulawesi, for example, has five 1,000-kW generating units; and in Biak, West Iran, the Indonesian Air Force and Navy have generation facilities with 1,240-kW output, while the Civil Aviation Authority had a 100-kW diesel unit.

At least one provincial government in Indonesia provides electric service for its region. The Maskagai Perusahaan Selempat (MPS), an agency owned and operated by the provincial government in South Sulawesi, generates electricity for about 20 cities and villages. However, in some areas of the State, PLN provides generation service and sells the power to MPS for distribution.

Nonutility government expenditures for electrical energy equipment are expected to remain high throughout the rest of the 1970's, though the sector's percentage share of the market is expected to fall from a 40% high in 1974 to 23% in 1979. Sector users are predicted to spend more than $34 million on generation equipment and over $11 million on transmission and distribution equipment in 1979.

Adanced Technology/Alternative Sources of Energy

There is considerable interest in geothermal energy in Indonesia, but the two 30-MW geothermal projects at Kamojang and Dieng which PLN planned for construction between 1975 and 1980 have encountered substantial economic and engineering difficulties. With U.S. Agency for International Development funding, PLN completed the initial drilling in the Dieng plateau of Central Java and has proposed a second-stage drilling program at a cost of $1.7 million. Power generation at this site is now scheduled to total one 5-MW unit. PLN hopes to have geothermal power generation of 40-MW capacity by 1980; trade sources project geothermal power generation at 70 MW by 1985.

PLN expects to utilize the large number of gas turbine plants now in operation or under construc-

tion to provide a combined cycle power system in the future. The first such system is forecast to be located at the Pulo Gadung industrial site near Djakarta where there are an estimated nine gas turbines.

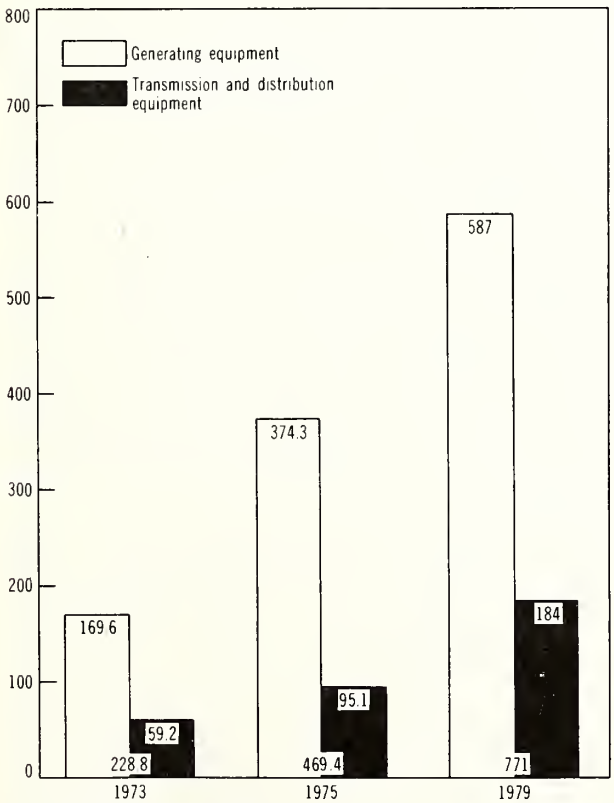
The highest transmission voltage project currently under construction in Indonesia is a 150-kV system being installed in Java, but the Government plans to develop a 400-kV "backbone" for this system in the future. Underground transmission is also being planned, with French financing and construction.

Electrical Energy Systems
Iran

Top government priority directed to electrical power expansion will ensure substantial investment in electrical generation, transmission and distribution equipment in Iran over the next decade. Expenditures on electrical energy systems rose from $189.5 million in 1972 to $469.4 million in 1975 (see table 1 and figure 1), and reach $771 million in 1979.

Petroleum revenues of more than $20 billion annually assure government planners the means to pursue their ambitious goals of new power plant construction. Electric utility generation capacity in 1980 is projected to be nearly triple that of 1974. Decentralization of industry, another facet of development policy, will boost transmission and distribution equipment purchases. By 1979, sales of distribution transformers and secondary unit substation transformers are forecast to be more than twice the figures of 1975.

Figure 1.—Iran: Total sales of electrical power equipment, 1973, 1975, and projected 1979[1/]
(in millions of U.S. dollars)



[1]For exchange rates, see table 1.

Source: Ministry of Power and Water; Tavanir (Generation and Transmission Company); Ministry of Finance, and Bureau of International Commerce, Office of International Marketing research study.

Already hedging against the day when petroleum resources will be depleted, the Iranian Government has allocated $1.2 billion for the purchase of nuclear reactors in the period 1978-85. The Atomic Energy Organization of Iran is preparing for 23,000 MW of nuclear power to be in operation by 1984. However heightened nuclear investment is not expected to reduce conventional generation equipment purchases, at least through the mid-1980's. Sales of power boilers and gas turbine generator sets are expected to grow briskly and are forecast to reach levels in 1979 almost double those of 1975.

Electric utilities, by far the most significant purchasers of electrical power equipment, accounted for 77% of total sales of equipment in 1972 and 80% in 1975. Projections place this sector's purchases at 85% of the entire market.

U.S.-manufactured generation equipment has proven highly attractive to Iranian purchasers. Total U.S. sales of electrical power equipment in 1974 were $38 million, or slightly over 17% of the entire import market.

Consulting engineers are used extensively for feasibility studies in both public and private sector power projects. Firms doing consulting work for the private sector generally specify equipment to be used. Government purchasing departments make their own purchasing decisions. In the public sector, consulting and contracting firms function separately.

Table 1.—Iran: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	106.2	134.3	157.4	301.6	499
Transmission and distribution equipment	39.8	46.3	57.0	75.0	160
Total	146.0	180.6	214.4	376.6	659
Industrial companies					
Generation equipment	19.2	20.8	27.0	37.8	60
Transmission and distribution equipment	7.3	8.1	10.5	12.8	17
Total	26.5	28.9	37.5	50.6	77
Government (other than utilities)					
Generation equipment	12.7	14.5	18.2	34.9	28
Transmission and distribution equipment	4.3	4.8	6.1	7.3	7
Total	17.0	19.3	24.3	42.2	35
Grand Total	189.5	228.8	276.2	469.4	771

[1] All figures converted at the following rates: 1972—US$1=75.75 Rials; 1973 and thereafter—US$1=69.30 Rials.

Source: Ministry of Power; TAVANIR (Generation and Transmission Company); Ministry of Economic Affairs and Finance; and Bureau of International Commerce, Office of International Marketing research study.

There are approximately 260 engineering firms in Iran, 10 of which do the bulk of all business. In almost all cases Iranian firms still rely on foreign firms to provide assistance on all phases of engineering. Presently very few U.S. consulting and contracting engineers operate in Iran, but opportunities for U.S. firms in this area are growing.

Competitive Evironment

Imports account for almost all of Iran's electrical energy systems requirements, and trade sources predict that foreign manufacturers will retain at least 98% of the total market through 1979. Because of the time lag involved between outlays of funds and actual importation of merchandise, imports comprise an even larger share of the total market than existing figures indicate. Electrical power equipment imports are supplied primarily by manufacturers located in the United States, the United Kingdom, Germany, and France (see table 2).

Imports.—Iran's imports of electrical power equipment rose from $188.3 million in 1973 to $215.5 million in 1974, and are projected to reach $346 million in 1979 (see table 3). U.S.-manufactured electrical power equipment showing particularly good sales potential include:

Fire-fed boilers (210-315 kW)
Gas turbine generators (17-60 kW)
Distribution transformers
Secondary unit substation transformers (1.300 kVA and up)
Power transformers (1,300 kVA and up)
Switchgear
Turnkey power plants with gas turbine generators as primary power source
High-intensity overhead cable
Turnkey nuclear power generation system
Portable generator units for industrial construction use
Super heaters
Ion exchangers
Porcelain insulators
All types of measuring and test equipment

Imports from third country suppliers increased from $158.2 million in 1973 to $177.5 million in 1974 and are expected to reach $281 million in 1979. However, the third-country share of total imports is predicted to fall from 84 to 81% in the 1973-79 period. The United Kingdom, France and Germany are the most important of these suppliers.

The ability of German manufacturers to offer favorable financing terms, coupled with a reputation for quality equipment, has given them a substantial share of Iran's power equipment purchases. Trafco-Siemens, a German joint venture, has been particularly successful with its transformer assemblies in the 100-1,300-kVA range.

French suppliers, relative newcomers to the market, have offered prompt delivery and advantageous financial arrangements. Steam turbines account for a predominant share of French imports; 32% of Iran's purchases are provided by Alsthom. Manufacturers from the United Kingdom benefit from their reputation in Iran for dependable equipment and a well-structured marketing strategy.

Techno Prom Export of the Soviet Union recently won contracts for six power boilers and Japanese manufacturers are working with a French firm on an electrical power project for Iran. However, because of the well-entrenched position of manufacturers from the United States, the United Kingdom, Germany, and France, suppliers from other countries are expected to account for declining shares of Iran's imports of electrical power equipment in the coming years.

The key to increasing sales of smaller pieces of electrical energy equipment in the Iranian marketplace is to keep readily available stocks. Competitive prices, favorable financing, and prompt delivery also play significant roles in choice of supplier.

Trade and technical regulations.—Iran has trade agreements with several countries, such as the United States and France, and in these cases preferential treatment may be afforded a particular supplier. No official preferential tariff rates apply to imports of power equipment as a whole. Further import tariffs and additional preferential purchasing agreements may be established in the future as a result of further

Table 2.—Iran: Major suppliers of electrical power equipment

Domestic manufacturers

Iran Cable Company (joint venture with American Cable Company, U.S.)
HV cables

Trafco-Siemens (subsidiary of German firm)
Power transformers, 100-1,300 kVA

Machine Sazi Arak
Power boilers

United States manufacturers

General Electric Company
Gas turbines

Westinghouse Electric Corporation
Gas turbines

Ingersoll-Rand
Generators

Onan
Generators

General Motors Corporation
Generators

Combustion Engineering
Power boilers

Control Bailey Meters System
Power boilers

Third-country manufacturers

Alsthom (France)
Gas turbines, steam turbines

PCL Ltd. (United Kingdom)
Diesel generators

Dale Ltd. (United Kingdom)
Diesel generators

Trafco-Siemens (Germany)
Transformers

General Electric (U.K., subsidiary of General Electric, U.S.)
Power boilers

Stork Werkspoor (Austria)
Diesel generators

Brown-Boveri (Switzerland)
Gas turbines, switchgear

Ruston (United Kingdom)
Gas turbines

Siemens (Germany)
Switchgear

Skoda (Switzerland)
Power boilers

Transformatoren Union AG (Germany)
Power boilers

Source: Bureau of International Commerce, Office of International Marketing research study.

bilateral trade agreements, and as Iran develops manufacturing capability. No technical standards govern the importation of electrical power equipment in Iran. In regard to safety regulations, most large end users request that the supplying company furnish equipment in accordance with the standards of its country.[1]

Trade practices.—Tender procedures are observed for all large purchases of power equipment. The Generation and Transmission Company, TAVANIR, arranges for the purchase of heavy-duty equipment, such as main transformers of large generators, while Sakht Vatahieh Khalaye Bagh (Satkab) arranges for the purchase of smaller pieces of basic equipment needed by the 11 regional power companies. The bulk of the heavy-duty equipment is sold by local sales offices of the various foreign manufacturres, and valuable assistance is usually obtained from factory representatives.

Domestic production.—Iranian manufacturers are not expected to satisfy more than 2% of the country's total requirements for electrical power equipment before 1979. Inadequate infrastructure has restricted manufacture, and the Government thus

[1] The electrical power supply throughout Iran follows a system of 220-380 volts, 50 hertz, single- and 3-phase. The metric system of weights and measures is the statutory standard throughout the country.

Table 3.—Iran: Estimated imports of electrical power equipment, 1973, 1974, and 1979 [1]
(in millions of U.S. dollars)[2]

	1973	1974	1979
Generation equipment			
United States	27.9	34.2	56
United Kingdom	33.7	42.1	50
Germany	26.8	30.2	54
France	17.5	21.6	32
All others	39.7	34.8	53
Subtotal	145.6	162.9	245
Transmission and distribution equipment			
United States	2.2	3.8	9
Germany	9.8	13.7	28
United Kingdom	8.7	11.2	21
France	5.2	8.3	18
All others	16.8	15.6	25
Subtotal	42.7	52.6	101
Totals			
United States	30.1	38.0	65
United Kingdom	42.4	53.3	71
Germany	36.6	43.9	82
France	22.7	29.9	50
All others	56.5	50.4	78
Grand Total	188.3	215.5	346

[1] Does not include nuclear generators.
[2] For exchange rates, see table 1.
Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Iranian statistics and trade source estimates.

far has not given incentives to private industry for equipment production.

End Users

Electric utilities.—The Iranian Government's Development Plan for 1973-78 allocates almost $6 billion to the electric utilities sector including approximately $1.8 billion for equipment purchases. Capital investment rose from $181.8 million in 1973 to $220 million in 1974 and is projected to exceed $810 million in 1980 (see table 4). Generation expenditures are projected to rise from their 1974 level of $163 million to $616 million in 1980. These outlays will be increased by payments for nuclear generating plants scheduled for operations in the mid-1980's. Transmission and distribution spending is forecast to grow from $57 million to $194 million in the 1974-80 period.

Equipment expenditures by electric utilities increased dramatically in the 1972-75 period (see table 5). They are expected to grow from $376.6 million in 1975 to $659 million in 1979. Trade experts predict that spending for power boilers in 1979 will be 89% greater than in 1975. Sales of gas turbine generator sets should also grow briskly through the late 1970's and early 1980's, as the Government replaces diesel generators to take advantage of abundant natural gas reserves, to aid in pollution abatement, and to boost power output. Large power transformers, distribution transformers, and secondary unit substation transformers should also see strong demand.

Total electric utility generating capacity in 1980 will be almost triple that of 1974, with gas turbine generation dramatically expanded (see figure 2). To keep up with growing power consumption by industrial and residential users, Government planners aim for creation of more than 30 new generating units in 1965-85 (see table 6). Sizable increases in generating capacity are planned for the R.S..K Dam in

Table 4.—Iran: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in millions of U.S. dollars)[1]

	1973	1974	1980
Generation			
Fossil	83.3	96.3	250
Nuclear	—	—	200
Hydro	5.1	5.6	24
Gas turbine	43.3	56.0	140
Internal combustion	7.7	5.1	1
Geothermal	—	—	1
Total	139.4	163.0	616
Tranmission	18.5	22.8	93
Distribution	23.9	34.2	101
Total	181.8	220.0	810

[1] For exchange rates, see table 1.

Source: Ministry of Power, Iran: and Budget Plan Organization, Iran; and Bureau of International Commerce, Office of International Marketing research study.

Table 5.—Iran: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	44.5	68.2	80.7	96.8	183
Nuclear reactors	.6	—	—	100.0	150
Turbine generator sets					
Steam	16.2	15.1	15.6	27.5	34
Gas	26.1	43.3	56.0	73.0	131
Diesel motor generator sets	18.8	7.7	5.1	4.3	1
Total	106.2	134.3	157.4	301.6	499
Transmission and distribution equipment					
Distribution transformers	6.0	6.9	8.5	11.2	32
Small power transformers	1.2	1.4	1.7	2.3	3
Secondary unit substation transformers	10.3	12.0	14.8	19.5	46
Large power transformers	12.3	14.4	17.7	23.2	48
Power regulators and boosters	2.8	3.2	4.0	5.3	8
Switchgear	3.2	2.8	4.6	6.0	13
Power circuit breakers	2.4	3.7	3.4	4.5	5
Control circuit relays	1.6	1.9	2.3	3.0	5
Total	39.8	46.3	57.0	75.0	160
Grand Total	146.0	180.6	214.4	376.6	659

[1] For exchange rates, see table 1.

Source: Ministry of Power; TAVANIR; Ministry of Economic Affairs and Finance; and Bureau of International Commerce, Office of International Marketing research study.

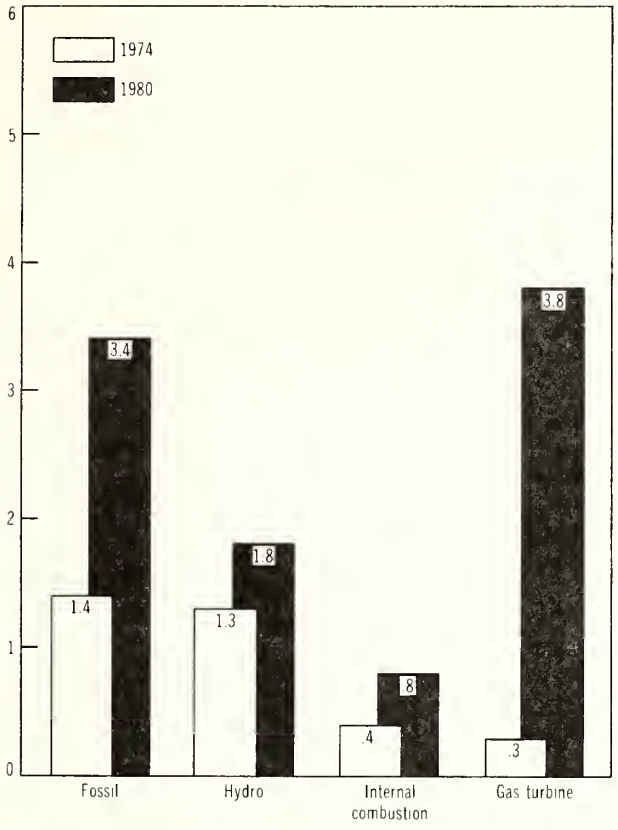
Khuzistan (adding 1,000 MW), to the Neka Plant in Mazandaran (600 MW) and the Tabriz Plant in Tabriz (600 MW).

Iran is committed to the purchase of eight nuclear power reactors, all to be operated by either boiling or pressurized water. Two, supplied by French manufacturers, are presently in construction; the remaining six (two from German suppliers, four from U.S. suppliers) have yet to be scheduled for construction. The German-supplied reactors will be manufactured by K.W.U. at a cost of approximately $210 mililon apiece and have a generating capacity of 1,200 MW each. All present purchase agreements include hiring of technicians and institution of training programs to provide for sustained operation of the equipment. The reactors will be owned and managed by the Government of Iran, and no licenses will be issued to private investors. Nuclear safeguards proposed by U.S. atomic energy authorities will be employed.

The Ministry of Power, which has overall responsibility for public utilities is comprised of the Planning Department, the Engineering Projects Department, the Department of Control at Regional Power Companies (which assumes financial control), and the Training Center. TAVANIR is the planning arm of the Ministry and is responsible for supplying power to the 11 regional power companies located throughout Iran.

The public sector provides almost 70% of the

Figure 2.—Iran: Electric utility generating capacity, 1974 and projected 1980 (in gigawatts)



Source: Ministry of Power; and Water and Bureau of International Commerce, Office of International Marketing research study.

electrical power consumed in Iran; the bulk of the remaining power consumption is supplied by the more than 100 private firms which generate power to operate their plants. Additionally, the military uses mobile generators to provide power in remote areas.

Industrial end users.—Power equipment expenditures by the industrial end-user sector have almost doubled in the 1972-75 period and are projected to reach $77 million in 1979. In general, industrial end users rely on the utilities for their primary power source and use standby generators during peak hours for power failures.

High sales potential in the industrial end-user sector is anticipated for:

DC generators (under 150 kW)
Diesel generators (under 50 MW)
Transformers (over 500 kVA)
Switchgear assemblies (for under 750 V)
Valves, taps, and fittings
Power wire and cable (for 10 kW and over)

Table 6.—Iran: Current and planned construction/ expansion of electrical power plants, 1975-85 [1]

Type	Number of units added [2]	Total generating capacity added (MW)
Fossil	10	998
Gas turbine	16	658
Hydro	5	1,140

[1] A detailed breakdown of individual construction projects giving such information as names of contracting engineers, starting and expected completion dates, etc. can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] Figure given is a minimum.

Source: Bureau of International Commerce, Office of International Marketing research study.

Government (other than utilities).—The government end-user sector needs power generators, transformers, and cables for its projects in rural areas of Iran and for backup systems for existing power sources. Recently, the National Iranian Radio and Television Organization purchased 200 mobile generators to supply power for educational television broadcasts in rural villages. Such generators account for about 16% of all generation equipment sold in Iran.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on Iran is available on a continuing basis from:

Country Marketing Manager—Iran
Commerce Action Group for the Near East
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

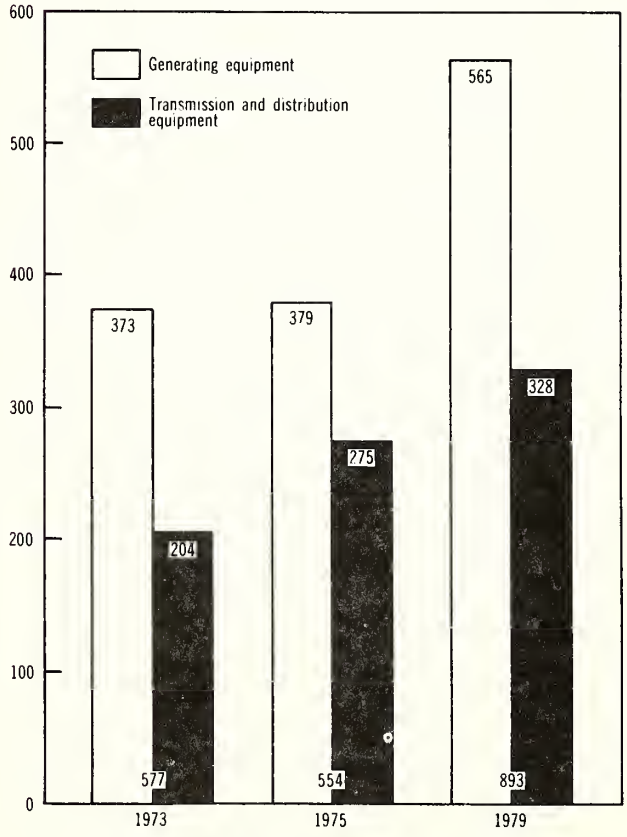
The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Iran," DIB 76-01-501, August 1975.

Electrical Energy Systems
Italy

The Italian market for electrical generation, transmission and distribution equipment has grown steadily since the early 1950's, reaching $577 million in 1973 (see table 1). After a slight decline in 1974, the market recovered and advanced to more than $650 million in 1975. Trade sources expect Italian consumption of electrical energy systems to exceed $890 million in 1979. Generation equipment usually accounts for about 60% of sales (see figure 1).

Figure 1.—Italy: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Italian statistics and trade source estimates.

Ente Nazionale per l'Energia Elettrica (ENEL), the state-owned electric utility company, purchases nearly 90% of the electrical energy equipment sold in Italy. ENEL plans to invest heavily in nuclear power equipment. If current plans are realized, purchases of nuclear reactors should account for $80 million of the $505 million generation equipment expenditures in 1979.

Competitive Environment

Italy has a well-developed electrical power equipment manufacturing industry able to supply virtually the entire local market (see table 2). German firms now have a clear lead in the small import market, but French companies are expected to increase their Italian sales rapidly.

Imports.—Italian end users spent about $17 million per year for imported electrical power equipment in 1973-74; they anticipate a rise in expenditures to around $21 million by 1979 (see table 3). Roughly 56% of the foreign-built equipment purchased is for transmission and distribution.

U.S. suppliers provided electrical power equipment valued at $1.6 million in 1974, including about 11% of generation and 7% of transmission and distribution equipment imports. American-made goods are not usually price-competitive, but are purchased primarily because there is no Italian equivalent. Most U.S. equipment is sold through the manufacturers' own subsidiaries or agencies, since local agents are reluctant to handle and develop markets for new products. U.S. companies wishing to introduce their products in Italy would do well to find a domestic producer willing to add American items to his catalog.

The best prospects for an increase in imports

Table 1.—Italy: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	231	327	280	325	505
Transmission and distribution equipment	166	183	211	248	298
Total	397	510	491	573	803
Industrial companies					
Generation equipment	35	37	40	44	48
Transmission and distribution equipment	15	17	19	22	24
Total	50	54	59	66	72
Government (other than utilities)					
Generation equipment	8	9	9	10	12
Transmission and distribution equipment	3	4	4	5	6
Total	11	13	13	15	18
Grand Total	458	577	563	654	893

[1] All figures converted at the following rates: 1972—US$1 = Lit 583; 1973—US$1 = Lit 583; 1974 and thereafter—US$1 = Lit 655.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Italian statistics and trade source estimates.

from the United States are associated with the building of nuclear power stations by licensees of General Electric (GE) and Westinghouse. U.S. sales of some specialized nuclear components and fuel enrichment and handling equipment are expected to rise slightly during the 1975-85 span.

German firms supplied 40% of the country's imported generation equipment and more than 50% of the foreign-made transmission and distribution products in 1974, with total electrical power equipment sales of $8 million. Siemens does some manufacturing in Italy, essentially to support exports from Germany—switchboards are fitted with German breakers and instruments, while transformer substations are built with German transformers. AEG sells power engineering products and supplies 5 to 6% of the motor control component market.

French firms sold electrical power equipment valued at $2 million in Italy in 1974, accounting for more than 11% of the imports of these products. Merlin Gerin imported a significant portion of the market for circuit breakers, and Legrand was a major supplier of domestic fuses. Sales by other French manufacturres were relatively small.

Trade and technical regulations.—Italy assesses no customs duties on electrical power equipment imported from other EEC countries. Tariffs imposed on U.S. goods range from 5 to 10% A value-added tax of 12% is levied on all products sold in Italy. No technical requirements are currently in force, but Italy is affiliated with the International Electrotechnical Commission (IEC) and a member of the International Commission on Rules for Approval of Electrical Equipment. The trend is clearly toward using IEC specifications.[1]

Trade practices.—Consulting and contracting engineers have little influence in Italy's electrical power industry. All electrical and mechanical equipment for the electric utilities is specified and selected by ENEL, although some specialized work on nuclear stations is placed with consultants. In the industrial sector, electrical work is usually handled, from design through construction, by either ASGEN, TIBB, or Marelli. The chemical and petrochemical industry uses some American consultant/contractor groups based in Italy; three of these U.S. firms are oil companies whose personnel prefer American electrical equipment for hazardous areas and tend to buy systems that have proved satisfactory in the United States.

Domestic production.—Although the Associazione Nazionale Industrie Elettrotechniche et Elettroniche comprises 549 companies, a few giants dominate Italy's electrical power equipment manufacturing industry. Virtually all the domestic boiler and turbine market is supplied by two companies—Ansado Meccanico Nucleari, associated with ASGEN for turbogenerators; and Tosi, associated with Marelli for turbogenerators. These firms manufacture 70% of the country's stationary generation equipment.

A great many firms manufacture diesel generators, but 60 to 70% of the market is covered by nine companies including Fiat and Breda. Fiat gas turbines with 100 MW capacities are probably better than any made in Germany or France, but not as good as those produced by U.K. firms. Some of the Breda mobile boiler units are better than any manufactured elsewhere in Europe.

Italtrafo holds about 60% of the Italian transformer market. Industrie Elettriche Legano and Officine Elettromechaniche Lombarde, S.p.A. each supply about 10%, and 20 smaller companies share another 10%.

Magrini-Galileo switchgear equals any European brand and is used in over 50% of domestic applications. ASGEN provides more than one-fourth of the market for the magnetic blowout type used by industry, and Vanossi has 20% of the minimum oil sector. Only Magrini manufactures circuit breakers using SF6.

Three groups have been formed in Italy to produce nuclear power plants. The consortium Elettronucleare Italiana and a group of research manufacturers working in this framework of the state-

[1] Electrical power is supplied in 220 V, 50 hertz, singlephase, or 380 V, 50 hertz, 3-phase. A great deal of 110-V, 50-hertz supply is being supplanted as quickly as is practical. The metric system of weights and measures is the statutory standard. Information on the availability of published standards in Italy may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Table 2.—Italy: Major suppliers of electrical power equipment

Domestic manufacturers

Ansaldo Meccanico-Nucleari (AMN) (licensee of General Electric, U.S.)
Boilers, turbines

ASGEN (licensee of General Electric, U.S.)
Steam generators, switchgear

Franco Tosi (licensee of Westinghouse, U.S.)
Boilers, turbines

Ercole Marelli (licensee of Westinghouse, U.S.)
Generators, alternators

Italtrafo
Transformers

Fiat
Diesel generators

Breda Termomeccanica
Diesel and steam generators, reactor pressure vessels

Magrini-Galileo (small share held by Westinghouse, U.S.)
Switchgear

Tecnomasio Italiano Brown-Boveri (TIBB) (subsidiary of Brown-Boveri & Cie. Germany)
Transformers, generators, wide range of electrical equipment

SACE S.p.A. (subsidiary of Brown-Boveri & Cie., Germany)
Switchgear, wide range of other electric equipment

Third-country manufacturers

Siemens (Germany)
Circuit breakers, instruments

AEG (Germany)
Motor control components

Brown-Boveri & Cie (Germany)
Turbines

Merlin Gerin (France)
Circuit breakers

Legrand (France)
Domestic fuses

Source: Bureau of International Commerce, Office of International Marketing research study.

controlled IRI-Finmeccanica have already been awarded contracts by ENEL. The third group, Societe per Imprese Nucleari (SPIN), comprising three Italian firms—FBM Construzioni Meccaniche, Societe Nazionale Industria Applicozione (SNIA) Viscosa, and TIBB—and two American companies —Babcock & Wilcox and Stone & Webster engineering—is quite new.

The IRI group is led by AMN-Impianti Termici e Nucleari, an engineering company that acts as main contractor for the design and acquisition of complete boiling water reactor (BWR) plants. It holds the GE license in this field and is prepared to start construction on two nuclear power plants per year. Manufacturing for the group is concentrated in Ansaldo Societa Generale Elettromeccanica, which has five large works with a 10,000-man labor force. These plants can supply large machinery and components, turbines, alternators, and reactor internals.

Other companies within the IRI group include Progettazioni Meccaniche Nucleari, which has just concluded a license agreement with Atomic Energy of Canada Ltd. for CANDU reactors, and Societe di Architettura Industriale per gli Impianti di Generazione di Energia (SAIGE), an architectural/engineering company in the field of power generating plants. Italimpianti, an engineering company within the IRI empire, is constructing a 600-MW CANDU heavy water reactor plant in Argentina in a joint venture with AECI.

The Elettronucleare Italiana (El) consortium, consisting of Fiat, Breda, Tosi, and Marelli, relies on Westinghouse technology. Tosi is responsible for turbines and the thermal cycle, while Marelli supplies alternators and electrical machinery. Breda and Fiat recently established the Societa Impianti Generazione Energia Nucleare (SIGEN) to provide nuclear islands for pressurized water reactor (PWR) plants. SIGEN and Westinghouse set up the Societa Progettazione Reattori Nucleari to help in the design of specialized components.

One of the first Italian companies to design, manufacture and assemble large components for nuclear plants was Terni-Societe per l'Industria e l'Elettrica. In the late fifties, Terni supplied the vessel for one of the country's first BWR stations. Today it can furnish nuclear plants with vessel and reactor internals for a total 2,000 MW(e) per year of installed capacity and with steam generators for about 1,000 MW(e) per year. Another firm, Nuovo Pignone, manufactures reactor components and highly sophisticated equipment for uranium enrichment plants.

Although most of the domestic manufacturers of electrical power equipment are entirely Italian owned, several foreign firms have become influential. Westinghouse and GE have sold licenses to or bought shares in a number of important companies. GE had a major holding in Compagnia Generale di Elettricita (CGE), which was partly integrated into ASGEN. The motor control part of CGE remains in GE control and has acquired a component company from Pirelli. This firm has emerged as a very successful and important panel builder with

Table 3.—Italy: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in millions of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	.8	.9	1
Germany	2.9	3.0	4
France	1.0	1.0	1
All others	2.7	2.8	3
Subtotal	7.4	7.7	9
Transmission and distribution equipment			
United States	.7	.7	1
Germany	5.0	5.0	6
France	1.0	1.0	1
All others	3.0	3.0	4
Subtotal	9.7	9.7	12
Totals			
United States	1.5	1.6	2
Germany	7.9	8.0	10
France	2.0	2.0	2
All others	5.7	5.8	7
Grand Total	17.1	17.4	21

[1] For exchange rates, see table 1.

Source: Italian Trade Statistics 1973 and Bureau of International Commerce, Office of International Marketing research study.

component facilities. It also leads the market in crane controls and is important in other sectors.

Other American companies manufacturing in Italy include Honeywell, IBM, and Texas Instruments, all of which face no domestic competition for the computers and minicomputers used for systems control and automatic hydro plants and substations. Cutler-Hammer Italiana S.p.A. supplies about 1 to 2% of the motor control components market. Components for nuclear power stations are produced by Walwarth Aloyco e Grove International (primary and secondary circuits) and subsidiaries of Union Carbide (nuclear grade graphite components) and Reactor Systems (design and production of mechanical components and systems).

Brown-Boveri & Cie. (BBC) of Germany has two major subsidiaries in Italy, Tecnomasio Italiano Brown-Boveri S.p.A. (TIBB) and SACE, S.p.A., manufacturing the entire range of electrical equipment. Elettrocondutture S.p.A. is also a licensee. BBC companies have captured roughly 15% of the market for rotating machines; 30%, generating equipment; 6%, transformers; 25%, switchgears; and 15%, panel components. ADDA-Officine Elettrotecniche Meccaniche S.p.A., a subsidiary of Delle of France, supplies about 20% of the switchgear market.

Italian manufacturers export over 50% of their electrical power equipment output. The major generator producers have large engineering staffs that search the world for municipalities and industries that need new sets in the range of 1-100 MVA. The Italians get their fair share of the bids, particularly from South America, but they have had huge losses on some contracts from inabiilty to secure adequate protection against inflation and devaluation. Breda has been particularly successful on the world market. The company has developed an imposing list of orders for reactor pressure vessels, steam generators, and pressurizers; it also exports know-how and patents.

Domestic firms benefit from the buy-national policy of ENEL. During the 1960's, when orders from the electric utility were high, the power equipment manufacturing industry flourished. However, ENEL's purchases began dropping sharply in the early 1970's, partly because its work was done and partly because it was forced to phase back many projects.

To survive in a market growing by 7 to 10% annually, Italian electrical power equipment producers have had to merge, close down, and generally reduce output. Theoretically, this rationalization could lead to greater opportunities for subsidiaries of German firms, but in fact, these companies have not been particularly prosperous.

The Government is helping to sustain some local producers by building large, state-controlled steel and chemical works. At least part of the reason for constructing these plants is to provide enough orders from the IRI steel company to the IRI electrical equipment firm (ASGEN) to keep together a project team for sets of 25-200 MW.

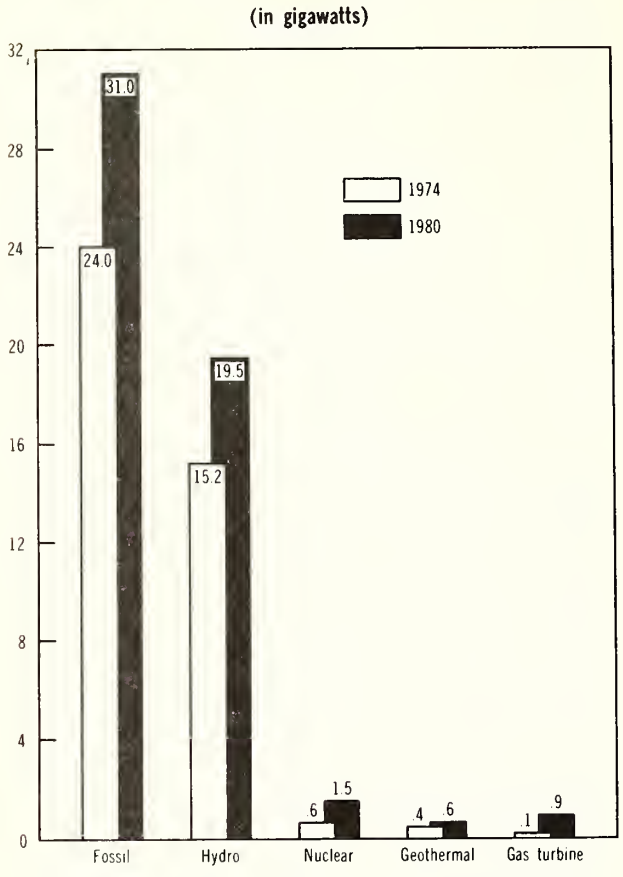
Overall, electrical equipment manufacturers import about 10% of their components and subassemblies, although some of the smaller companies such as diesel generator set producers often buy over 50% of their parts. American manufacturers can find some excellent sales opportunities. Molded-case circuit breakers head the list of products for which an unexploited market exists. Panels made in Italy from imported U.S. components have good potential. Square D and Cutler-Hammer have already entered the market, but there is room for others. Pneumatic relays, electronic time delay relays, and other "fringe-type" control components are of specific interest.

Sophisticated self-regulating alternators as well as petrol and diesel engines, including marine versions for the large fishing fleet, can be sold to set builders. Modern fire detection and control system for diesel generators are not available in Italy. Fire, gas, radiation, and safety alarms of all kinds are in demand, either in component form or as part of a complete safety surveillance system coupled to automatic emergency lighting systems complete with diesel or petrol generator.

End Users

Electric utilities.—ENEL was established in 1963 and given full responsibility for the generation,

Figure 2.—Italy: Electric utility generating capacity, 1974 and projected 1980



Source: ENEL Reports for 1973 and 1974 and Bureau of International Commerce, Office of International Marketing research study.

transmission, and distribution of electrical power in Italy. Although ENEL had the authority to acquire all public electric supply enterprises immediately, it chose to gradually acquire companies from their shareholders and municipalities. Since its formation, ENEL has invested $2.8 billion, integrated 1,163 firms, and built base load stations and a modern national grid.

Demand for electricity in Italy rose steadily for many years. The utilities sold more than 59 terawatthours (TWh) in 1961, nearly 108 TWh in 1969, and 137 TWh in 1973. Growth faltered and dropped by about 50% in 1974; in the first 7 months of 1975, there was a slight decline. Hydroelectric plants supplied more than 67% of the country's power in 1962; by 1973, hydro stations provided less than 40% and thermal stations accounted for 57%. Geothermal and nuclear together accounted for the remainder.

Assuming a 6% annual increase in electricity consumption over the rest of the decade, ENEL plans to enlarge generating capacity from 40,300 MW in 1974 to 53,500 MW in 1980 (see figure 2). The oil crisis has led to some shifts in energy sources. ENEL's thermal stations were built to use either coal or oil; with slight modifications they can also take lignite or natural gas, which have both become more economical. Hydro and pumped hydro stations have become more feasible, although they tend to be remote from load centers, and consents for transmission lines are a major problem for ENEL. This situation could lead to a need for more gas turbine stations.

ENEL would like to build nuclear power stations rather than import massive amounts of fossil fuel. However, local government authorities generally disapprove because nuclear plants need so few employees. Some efforts are being made to develop geothermal energy, and at least one university is studying solar energy.

The utilities expended $280 million for generation equipment in 1974, and they project investments exceeding $500 million in 1979 (see table 4). Purchases of power boilers are expected to increase by about a third within the 5 years. Expenditures for nuclear reactors are projected to jump to $80 million by 1979. Gas turbines were first ordered in 1973 to make up for delays in transmission line construction; eight will be delivered between 1976 and 1978, and no further investment is expected until 1979.

In 1972, ENEL completed 169 primary substations with a transforming capacity of 2.2 million

Table 4.—Italy: Estimated equipment expenditures by electric utilities, 1972-75 and 1979
(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	90	90	103	110	150
Nuclear reactors	1	1	2	5	80
Turbine generator sets					
Steam	100	101	140	140	200
Gas	—	—	—	—	5
Hydraulic	40	135	35	70	70
Total	231	327	280	325	505
Transmission and distribution equipment					
Distribution transformers	30	35	40	45	50
Small power transformers	15	16	17	18	20
Secondary unit substation transformers	25	30	35	40	45
Large power transformers	30	35	40	45	60
Switchgear	60	60	70	90	110
Power circuit breakers	5	6	7	8	10
Control circuit relays	1	1	2	2	3
Total	166	183	211	248	298
Grand Total	397	510	491	573	803

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Italian statistics and trade source estimates.

kVA and 18,333 secondary substations with a transforming capacity of 1.6 million kVA. In the same year, 697 km of 40- to 150-kV lines and 10,546 km of medium-voltage lines together with 27,065 km of low-voltage lines, were erected at a cost of $506 million. Total expenditures for transmission and distribution equipment are forecast to rise from $211 million in 1974 to nearly $300 million in 1979.

ENEL built its first nuclear power plant, a 150-MW reactor, in 1964. This station, a Magnox 1 type, was a turnkey project of the Nuclear Power Group of England; it incorporates a Parsons turbine and Ansaldo alternator. That same year a second 150-MW, BWR-type station was built by GE with a steam raising plant by Stork (Netherlands) and turboalternators by Ansaldo (now ASGEN). A 260-MW, PWR-type plant, which was built on a turnkey basis by Westinghouse and completed in January 1965, has a Tosi turbine and Marelli alternator. These three stations have given excellent service with a high availability factor.

A fourth station, due for completion in 1975, is an 850-MW, BWR type with an AMN/ASGEN turboalternator and a Breda reactor vessel (see table 5). Four other 1,000-MW plants, costing more than $2.2 billion, are scheduled to be ready by 1980; two are being built by the EI group and the other two are BWR stations allocated to GE/AMN. Beyond 1980, the plan is to build 16 more 1,000-MW stations in two groups of 8.

In principle, the Italian nuclear industry seems prepared for its new tasks. The capacity of the existing groups has been estimated at three to four new plants (start of construction) per year. In 2 to 3 years, it can reach the rate of five nuclear plants initiated per year.

The Italian Government Planning Committee (CIPE) has decided to rationalize the state-controlled industry in the nuclear field and has assigned to the Ente Nazionale Idrocarburi (ENI) the leading role in the nuclear fuel cycle. The ENI group's AGIP Nucleare company is building a plant at Bosco Marengo to convert uranium into hexafluoride at the rate of 360 tons/year initial capacity, with a possibility of doubling production. AGIP also holds half of the Italian 25% interest in the EURODIF uranium enrichment plant under construction in France, and it participates in firms producing gas reactor fuel elements of the Magnox type and BWR fuel. A PWR fuel fabrication plant was built at Saluggia by a joint venture of Breda, Fiat, and Westinghouse; its present capacity is over 50 tons per year.

The construction of a fast reactor fuel element fabrication plant in Italy is under study by AGIP Nucleare jointly with the French Atomic Authority CEA. With the Italian National Committee for Nuclear Energy (CNEN), AGIP Nucleare is studying the design of a national plant for irradiated fuel reprocessing to start operation in the second half of the 1980's. Italian research and development programs in the field of uranium enrichment by processes of both gaseous diffusion and centrifugation are promoted by CNEN and coordinated by the Italian Group on Uranium Enrichment, with large participation by Italian industry.

Table 5.—Italy: Current and planned construction/expansion of electrical power plants, 1975-82 [1]

Type	Number of units added	Total generating capacity added (MW)
Termal	35	12,240
Hydro	27	5,492
Nuclear	5	4,850
Gas turbine	5	790
Geothermal	1	15

[1] A detailed breakdown of individual construction projects giving such information as name of contracting engineer, starting and expected completion dates, costs, etc. can be found in the original research. For instructions on how to order this study, see "Additional Information" box.

Source: ENEL Annual Report 1974 and Bureau of International Commerce, Office of International Marketing research study.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on Italy is available on a continuing basis from:

Country Marketing Manager—Italy
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Italy," DIB 76-03-502, October 1975.

ENEL has not issued any precise construction program or capital expenditure forecasts. For many years, the company has complained that work on its approved projects has been repeatedly halted by local authorities. All projected completion dates and investments have failed to materialize, and the delays and inflation have escalated costs. Considering all these factors, trade sources predict an increase of 23,387 MW in generating capacity over the 1975-82 period. Some 35 thermal stations with a total capacity of over 12,000 MW are either under construction or planned. Another 5,492 MW from hydro plants are expected to be added, as well as 790 MW from gas turbines, and 15 MW from one geothermal station.

Industrial end users.—Because the Italian power supply has not always been reilable or cheap, the generation of electricity by industry is both widespread and well established. In fact, the utilities purchased nearly 2% of their output requirements from industrial sources. Roughly one-sixth of the nation's installed capacity belonged to non-ENEL producers in 1973. In the same year, $37 million was spent by industry for generation equipment, increasing capacity by 848 MW. Counting only units over 1,000 kVA, 23 major firms such as Fiat, Italsider, and Montedison installed 847,730 kVA.

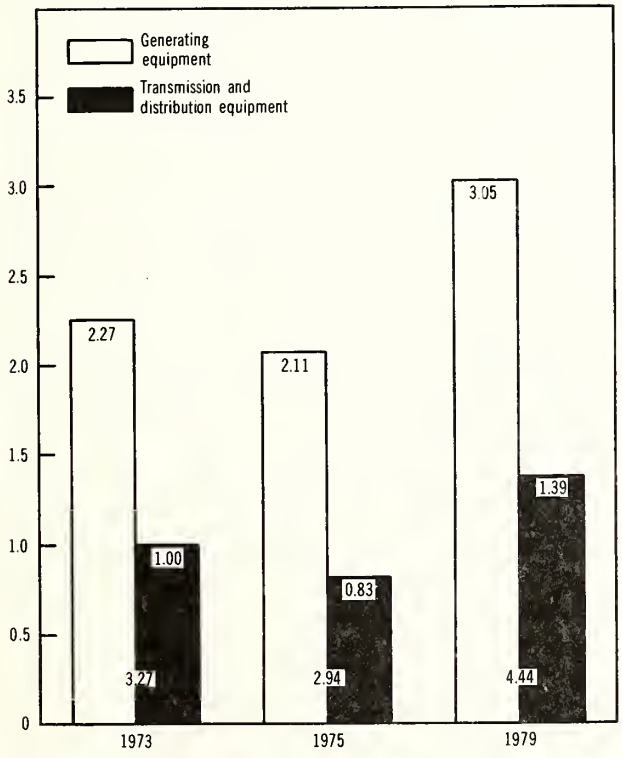
For practical purposes, no transmission equipment is sold to the industrial sector. Distribution equipment is purchased mainly by the 74,691 large-scale consumers (from a total of 277,444) in the sector. In 1973 expenditures for distribution equipment reached $19 million. Italian industry is projected to spend $72 million for electrical power equipment in 1979.

Electrical Energy Systems
Japan

Japanese investment in electrical generation, transmission and distribution equipment rose from $2.2 billion in 1972 to $3.4 billion in 1974 (see table 1 and figure 1). Although government pressures to reduce spending during the oil crisis brought a decline in purchases in 1975, expenditures are projected to reach almost $4.5 billion in 1979. U.S. firms dominate the import market, supplying equipment valued at $73.5 million in 1974.

Much of the growth in Japan's electrical power equipment market results from government efforts to substantially reduce the country's dependence on oil. These electric utility companies, which account for nearly three-fourths of the market, are investing heavily in nuclear power plants. However, various technical, economic, and social problems related to nuclear energy have yet to be resolved and so substantial reliance on conventional power sources will continue. Sizable funds are being allocated, though, for research in electricity generation from both geothermal and solar power.

Figure 1.—Japan: Total sale of electrical power equipment, 1973, 1975, and projected 1979 (in billions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Sources: "Machinery Statistics", Ministry of International Trade and Industry; "Japan Exports and Imports", Ministry of Finance; "Atomic Energy Industry under Inflation", Japan Atomic Industrial Forum; "No. 46, Japan Electric Power Survey Committee; and Bureau of International Commerce, Office of International Marketing research study."

Competitive Environment

Japanese manufacturers of generation, transmission, and distribution equipment (see table 2) acquire technology through licensing agreements with foreign companies, primarily U.S. firms, and now supply all but the most recently developed or highly specialized to domestic end users. Imports from the United States and third countries have slowly declined, accounting for less than 3% of the market in 1974. This trend is forecast to continue through the 1980's.

Imports.—Foreign producers sold electrical power equipment valued at nearly $97 million to Japanese consumers in 1974 and can expect 1979 sales of approximately $117 million (see table 3). Generation equipment accounts for about 78% of imports.

American technology is highly respected in Japan, as is evidenced by the close ties between U.S. and Japanese manufacturers and by U.S. dominance of the import market. American firms supplied over 76% of the imports in 1974, and are forecast to provide 74% in 1979. Nuclear reactors and turbine generators account for much of the rising share (83.2% in 1974 and a projected 85% in 1979) of the generation equipment import market held by

Table 1.—Japan: Sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	618.9	806.7	751.9	641.8	1,149
Transmission and distribution equipment	1,052.5	1,746.6	1,738.3	1,458.9	2,230
Total	1,671.4	2,553.3	2,490.2	2,100.7	3,379
Industrial companies[2]					
Generation equipment	181.9	182.4	199.5	191.7	245
Transmission and distribution equipment	360.6	523.2	729.6	649.3	822
Total	542.5	705.6	929.1	841.0	1,067
Grand Total	2,213.9	3,258.9	3,419.3	2,941.7	4,446

[1] All figures converted at the following rates: 1972—US$1=¥308; 1973—US$1=¥272; 1974 and thereafter—US$1=¥292.

[2] Includes government purchases.

Sources: "Machinery Statistics," MITI; "Japan Exports and Imports," Ministry of Finance; "Atomic Energy Industry under Inflation," Japan Atomic Industrial Forum, Inc.;" "No. 46 Japan Electric Power Survey Report," Japan Electric Power Survey Committee; and Bureau of International Commerce, Office of International Marketing research study.

American companies. U.S. firms also supplied nearly 60% of imported transmission and distribution equipment in 1974.

General Electric Company and Westinghouse Electric Corporation are the only U.S. manufacturers actively exporting electrical power equipment to Japan at the present time, although other companies may be contributing parts and components to systems before they are shipped. There is sales potential chiefly for U.S.-made equipment that is very technologically advanced and not available locally, and for price-competitive equipment.

Third-country manufacturers of electrical power equipment have no significant influence in Japan. Just over 13% of 1974 imports came from Germany and the United Kingdom combined. While European companies are considered to have technological expertise with regard to transmission and distribution equipment, especially switchgears, they rarely promote their products in Japan.

Trade and technical regulations.—All of the major foreign suppliers of electrical power equipment are members of the General Agreement on Tariffs and Trade (GATT) and are assessed duty rates ranging from 6 to 15% of the c.i.f. value of their products in Japan. Some generation equipment and items used in nuclear energy development are admitted free, providing they are of advanced design, not locally available, and they are used in the main production line. No other taxes are levied on imported electrical power equipment.

The Japanese Government has enacted stringent laws regulating electrical power construction projects and equipment. The Ministry of International Trade and Industry (MITI) establishes technical requirements for all generating, transmission and distribution facilities and equipment.[1] Nuclear power generation projects must be examined by the Atomic Energy Committee of the Prime Minister's Office to determine their compliance with national nuclear policy, their financial and engineering feasibility, and safety factors. In addition, air and water pollution laws apply to electrical power facilities, and no boiler or pressurized container may be sold without MITI's approval. Information on the availability of published standards in Japan may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Trade practices.—Major Japanese end users of electrical power equipment rarely base their purchasing decisions on the opinions or recommendations of independent consulting and contracting engineers. The large electric utility companies have a very high level of engineering capability; smaller utility firms seek the advice of the large companies. Sizable industrial end users maintain engineering departments which handle their electrical power facilities, while smaller industries rely on recommendations of the electrical power equipment manufacturers. Electrical and general contractors play the most important role in determining the types of power generation equipment used in office buildings, hospitals, computer centers, and so forth.

Domestic production.—Japanese manufacturers increased production of electrical power equipment an average 25% annually between 1972 and 1974, raising output from $2.5 billion to $3.9 billion. The products made by the industry's 90 firms in 1974 are shown in table 4.

Four corporate combines—the Mitsubishi, Toshiba, Hitachi, and Fuji groups—manufacture approximately two-thirds of the electrical power equipment produced in Japan. All significant companies in the electrical power equipment industry are either joint ventures or licensees of foreign companies. The Toshiba and Hitachi groups, which have licensing agreements with General Electric, and the Mitsubishi group, similarly related to Westinghouse, are the primary suppliers for the electric utility industry. The Fuji group sells mainly to the industrial sector.

The major domestic manufacturers have developed close relationships with particular end users; for example, Kansai Electric Power Company purchases almost exclusively from Mitsubishi. Local producers

[1] The electric power supply is AC, 100/200 volts, single or 3-phase Frequency differs by area, however, as it is 50 hertz in Eastern Japan and 60 hertz in Western Japan. Although Okinawa has a frequency of 50 hertz, the Okinawa Electric Co., Ltd. also supplies a frequency of 60 hertz. The metric system of weights and measures is the statutory standard throughout Japan.

Table 2.—Japan: Major suppliers of electrical power equipment

Domestic manufacturers

Mitsubishi group

Mitsubishi Heavy Industry, Ltd. (licensee of Westinghouse Electric Corp. and Combustion Engineering Co., U.S.)
Power boilers, nuclear reactors, and gas, hydraulic, steam, and geothermal turbines

Mitsubishi Electric Corp. (licensee of Westinghouse Electric Corp., U.S., which holds 5% equity)
Generators, transmission and distribution equipment

Toshiba group

Toyko Shibaura Electric Co. (licensee of Brown, Boveri & Co. Switzerland; AEG, Germany; and General Electric Co., U.S., which has 10.8% equity)
Geothermal, gas, hydraulic, and steam turbine generator sets, and nuclear power, transmission, and distribution equipment

Ishikawajima-Harima Heavy Industries Co., Ltd. (licensee of Foster Wheeler Corp., U.S.)
Power boilers, nuclear reactors

Hitachi group

Hitachi, Ltd. licensee of General Electric Co. and Foster Wheeler, U.S.)
Power boilers, gas, hydraulic, and steam turbine generator sets, and nuclear power, transmission, and distribution equipment

Babcock-Hitachi K.K. (joint venture with Babcock & Wilcox Co., U.S.)
Power boilers

Fuji group

Fuji Electric Co., Ltd. (licensee of Siemens, Germany, which holds 9.8% equity, and Allis-Chalmers Corp., U.S.)
Turbines, generators, transmission, distribution, and nuclear power equipment

Kawasaki Heavy Industry Co., Ltd.
Power boilers, nuclear power equipment

Meidensha Electric Mfg. Co., Ltd. (licensee of ASEA, Sweden, and AEG, Germany)
Power transformers, turbine generators

Shinko Electric Co., Ltd. (licensee of Allis-Chalmers Corp., U.S.)
Turbine and motor generators, transmission and distribution equipment

Takaoka Electric Mfg. Co., Ltd. (subsidiary of Tokyo Electric Power Co., Inc., and licensee of ASEA, Sweden)
Transmission and distribution equipment

United States manufacturers

General Electric Co.
Thermal and nuclear power plants

Westinghouse Electric Corp.
Thermal and nuclear power plants

Third-country manufacturers

General Electric Co. (U.K.)
Switchgear and power suppliers for industrial equipment

Source: Bureau of International Commerce, Office of International Marketing research study.

can generally supply electrical power equipment at a lower price than can foreign firms, and they also provide better aftersales service and availability of parts.

Japanese exports of electrical power equipment rose an average 24.3% annually between 1972 and 1974, or from $378 million to $584 million. Manufacturers are actively engaged in developing foreign markets and hope to increase exports well beyond the 15% of production that was shipped overseas in 1974. In order to meet the technical requirements of other countries, foreign-made components and instrumentation are incorporated into products for export.

End Users

Electric utilities.—Capital expenditures by Japanese utilities exceeded $5 billion in 1974 and are expected to reach $8 billion by 1980 (see table 5). Between 1973 and 1975 the utilities increased their generating capacity an average 9% annually to nearly 98 billion MW, and they plan to add another 36 billion MW by 1980. Two-thirds of the nation's electricity was produced with fossil fuels, primarily petroleum, in 1975 (see figure 2). Generating capacity based on liquid natural gas is expected to increase by an average 28% yearly between 1975 and 1980, compared to a 2.5% annual increase for petroleum. Nuclear energy, which accounted for almost 7% of generation capacity in 1975, is expected to supply 12% in 1980 and over 25% by 1985.

Electric utility companies spent an average $705 million a year for generation equipment between 1972 and 1975 and anticipate expenditures in excess of $1 billion in 1979 (see table 6). The largest demand is for steam turbine generator sets, since they are readily adapted to various fuels. Nuclear reactors are rapidly replacing power boilers and are projected to account for 38% of the generation equipment purchased in 1979. Both gas and hydraulic turbine generator sets are being developed as supplemental power sources. Sales of gas turbines are expected to fluctuate around $36 million per year throughout the 1972-79 period. Motor generators are used primarily by small utility companies located in remote rural areas or on small isolated islands; nearly all of these generators are powered

Table 3.—Japan: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in millions of U.S. dollars) [1]

	1973	1974	1979
Generation equipment			
United States	98.9	57.4	73
United Kingdom	3.6	4.8	1
Germany	7.5	2.4	6
All others	12.0	4.7	6
Total	122.0	69.3	86
Transmission and distribution equipment			
United States	12.2	16.1	14
Germany	4.3	4.3	4
United Kingdom	1.0	1.7	—
All others	4.8	5.2	13
Total	22.3	27.3	31
Total			
United States	111.1	73.5	87
Germany	11.8	6.7	10
United Kingdom	4.6	6.5	1
All others	16.8	9.9	19
Grand Total	144.3	96.6	117

[1] For exchange rates, see table 1.

Source: "Japan Exports and Imports," Ministry of Finance; and Bureau of International Commerce, Office of International Marketing research study.

by diesel fuel. Investment in transmission and distribution equipment by the electric utilities averaged $1.5 billion yearly between 1972 and 1975 and is forecast at more than $2.2 billion in 1979.

Nine privately owned regional power companies dominate Japan's electric utility industry. Collectively, they control 79% of the nation's total generating capacity and distribute virtually all electricity produced in the country; they are also the primary end users of electrical power equipment (see table 7). Tokyo Electric Power Co., Japan's largest utility, leads the industry in introducing new equipment,

Table 4.—Japan: Domestic manufacture of electrical energy systems equipment

Product category	Number of local manufacturers [1]	Value of production 1974 (millions $US)
Power boilers	12	329
Nuclear reactors	10	196
Turbines, turbine generator sets	10	577
Motor generators	25	102
Power and distribution transformers	61	867
Switchgears	79	1,836
Total		3,907

[1] Many firms manufacture more than one product.

Sources: "Machinery Statistics," MITI; "The Atomic Energy Industry Under Inflation," Japan Atomic Industrial Forum Inc., and Bureau of International Commerce, Office of International Marketing research study.

Table 5.—Japan: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in millions of U.S. Dollars) [1]

	1973	1974	1980
Generation			
Fossil	648	618	963
Nuclear	670	736	1,639
Hydro	108	105	172
Pumped Storage	177	187	443
Gas turbine	36	34	56
Internal combustion	14	14	23
Geothermal	22	21	84
Total	1,675	1,715	3,380
Transmission	1,559	1,373	1,867
Distribution	647	675	795
Miscellaneous	1,045	1,429	2,005
Total	4,926	5,192	8,047

[1] For exchange rates, see table 1.

Sources: "Electric Utility Hand Book (Denki Jigyo Binran)," Federation of Electric Power Companies; "Summary of Facility Plan, Fiscal 1975," Agency of National Resources and Energy, MITI; "Long-term Electric Demand and Supply," Electric Utility Industry Council: MITI; and Bureau of International Commerce, Office of International Marketing research study.

and its research institute has had significant influence in improving various types of generation, transmission and distribution equipment.

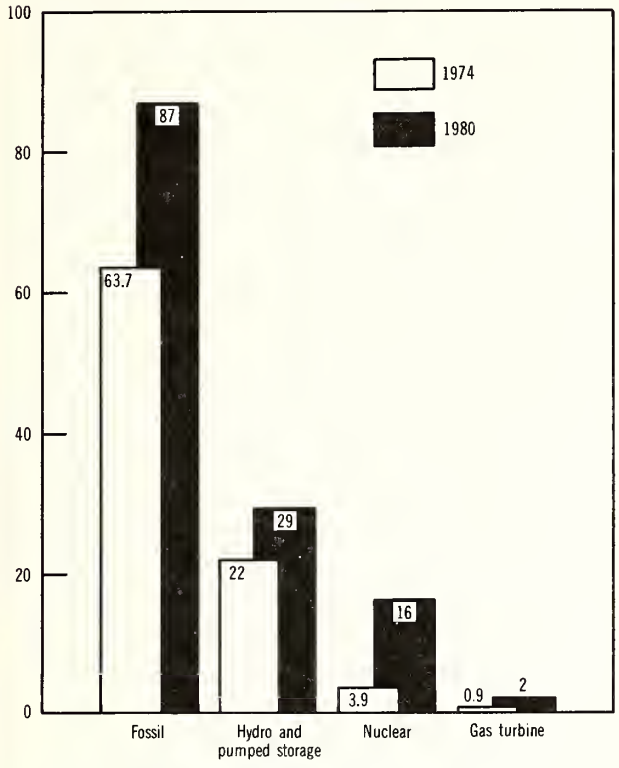
The 32 prefectural governments have all invested heavily in dam construction projects for various purposes. They generate hydroelectric power as a byproduct and transmit electricity to the nine regional companies for distribution.

Fourteen joint-venture companies have been established between the major electric utility companies and private industrial corporations. The largest of these, Tobata Kyodo Karyoku Co., Ltd., supplies electricity to its owners, Nippon Steel Corp. and Kyushu Electric Power Co., Inc., on a 50-50 basis. The company can now generate 562 MW of electricity utilizing gas exhaust from the steel company's blast furnace, and it plans to add 375 MW in the near future.

Japan had eight nuclear power stations with a combined generating capacity of 3,893 MW operating in 1975. These included one gas-cooled, four boiling water, and three pressurized water reactors. Another 13 nuclear power plants, 7 boiling and 6 pressurized water reactors, with a combined generating capacity of more than 11,000 MW are under construction. Six additional power plants with boiling or pressurized water reactors have been approved, with beginning construction dates ranging from October 1975 to April 1977. Their planned combined capacity is 4,947 MW. According to MITI's projections, Japan will have a nuclear generating capacity of 49,000 MW by the end of March 1985.

The Power Reactor and Nuclear Fuel Development Corporation (PNC), financed by public funds,

Figure 2.—Japan: Electric utility generating capacity, 1974 and projected 1980 (in gigawatts)



Sources: "Electric Utility Hand Book (Denki Jigyo Binran)", Federation of Electric power companies; "The Thermal and Nuclear Power", Thermal Power Engineering Society of Japan; "Long-term Electricity demand and Supply", Electric Utility Industry Council, Ministry of International Trade and Industry; and Bureau of International Commerce, Office of International Marketing research study.

has developed its own technology through basic research but as yet has not reached the technological level of U.S. and West European nuclear researchers. PNC has developed a heavy water reactor with a generating capacity of 165 MW to be used for experimental purposes. The corporation is also constructing a fast breeding reactor with a generating capacity of 100 MW and plans to complete another with 300-MW capacity by 1981.

The Japan Atomic Energy Research Institute (JAERI) is currently developing a high-temperature, gas-cooled reactor for both electrical power generation and operation of industrial processes such as blast furnaces. It is also conducting an extensive research program on pipe materials with the aim of developing pipes that can withstand the extremely high temperatures of helium gas.

Although Japan's nuclear energy technology development has been highly dependent on foreign technology, primarily from the United States, local firms now produce more than 90% of the equipment installed in nuclear power plants. However,

Table 6.—Japan: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. Dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	186.4	189.0	177.5	144.4	138
Nuclear reactors..	135.1	174.6	206.1	210.5	436
Turbine generator sets					
Steam	240.6	356.1	310.1	240.7	471
Gas	17.7	40.9	36.1	23.8	36
Hydraulic	34.3	39.2	17.8	19.2	63
Motor generator sets					
Diesel	4.8	6.9	4.3	3.2	5
Total	618.9	806.7	751.9	641.8	1,149
Transmission and distribution equipment					
Small power transformers ..	102.8	120.6	146.6	116.7	187
Large power transformers ..	27.4	38.1	47.2	37.9	60
Other transformers	122.9	211.2	188.5	169.2	259
Power regulators and boosters ..	133.7	228.8	244.3	197.0	301
Switchgear	459.6	783.9	767.6	641.9	983
Power circuit breakers	121.3	233.1	219.8	183.8	279
Control circuit relays	84.8	130.9	124.3	112.4	161
Total	1,052.5	1,746.6	1,738.3	1,458.9	2,230
Grand Total	1,671.4	2,553.3	2,490.2	2,100.7	3,379

[1] For exchange rates, see table 1.

Sources: "Machinery Statistics," MITI; "Japan Exports and Imports," Ministry of Finance; "Atomic Energy Industry Under Inflation," Japan Atomic Industrial Forum, Inc.; "No. 46 Japan Electric Power Survey Report," Japan Electric Power Survey Committee; and Bureau of International Commerce, Office of International Marketing research study.

manufacturers now capable of accurately duplicating equipment imported from their licensors nevertheless lack the necessary technological background to cope with operational problems of the plants and must rely on their foreign counterparts to solve technical problems.

The U.S. Atomic Energy Commission has agreed to supply Japan with enriched uranium sufficient for 62 power plants with 55,000-MW capacity. In addition, the major electric utility companies have concluded a contract with EURODIF for the purchase of 10,000 metric tonnes of SWU's during the 1980-85 period. Japan is actively engaged in research and development projects to produce the necessary technology to build its own enriching facilities, and PNC plans to construct by 1985 a uranium enrichment plant with a capacity of upwards to 5,000 metric tonnes annually. At present, Japan's used nuclear fuel is reprocessed by British Nuclear Fuels

Table 7.—Japan: Composition of electric utiliites by ownership, 1973

	Number of utilities	Percent of total generating capacity
Private	9	79
Federal (semi-governmental)	3	8
State	32	11
Cooperative (private utilities and private industries)	14	2
Total	63	100

Source: Bureau of International Commerce, Office of International Marketing research study.

Limited, but PNC is constructing a reprocessing factory able to handle 210 metric tonnes yearly. It should be ready to operate by the spring of 1976. While this plant will meet current needs, another plant with an annual capacity of 1,500 metric tonnes is slated for completion by 1985.

In addition to nuclear power plants, about 40 other electrical power plants have been approved for construction, and another 60 are awaiting approval (see table 8). Altogether, these projects should yield 17.6 gigawatts (GW) and cost nearly $7 billion. U.S. firms may find excellent sales potential for such items as steam turbine generator sets (over 1,100 kW), fuel cells, heat exchangers, nuclear power generation systems and accessories, relays, circuit-breakers (SF6), combustion control equipment, coal gasification and liquefaction equipment, lignite-burning equipment, and solar energy systems.

Industrial end users.—Japanese industrialists increased their purchases of transmission and distribution equipment by an average 42% annually between 1972 and 1974 (to $730 million) and raised investment in generation equipment an average 4.7% annually during the same period. Recessionary pressures led to a decline in expenditures in 1975, but expenditures for generation, transmission and distribution equipment are projected to reach $1 billion by 1979. Virtually all the equipment used in this sector is manufactured domestically; within the last 5 years, only two units of foreign-made power equipment with a capacity of more than 1 MW have been purchased.

New Technology/Alternative Sources of Energy

The Japanese Government in 1975 made public a long-term national energy policy aimed at a sharp reduction in dependence on imported oil as a major source of energy. Oil accounted for 61.2% of Japan's ener for electricity generation in 1974, but by 1985 this amount is to be reduced to 32.6%.

Table 8.—Japan: Current and planned construction/ expansion of electric power plants, 1975-80 [1]

Type	Number of Units added	Total generating capacity added (MW)	Total cost (in millions of U.S. dollars)[2]
Approved projects			
Hydro	11	216.7	515.8
Pumped storage	8	2,346.0	577.4
Nuclear	2	1,090.0	636.0
Geothermal	2	105.6	63.1
Fossil	12	5,233.0	1,465.9
Internal combustion	5	8.8	9.7
Total	40	9,000.1	3,267.9
Projects pending approval			
Hydro	16	280.9	592.0
Pumped storage	1	17.1	12.2
Geothermal	1	50.0	16.7
Fossil	17	6,196.3	2,276.6
Internal combustion	25	2,053.5	588.4
Total	60	8,597.8	3,485.9

[1] For exchange rates ,see table 1. A detailed breakdown of industrial construction projects giving such information as names of contracting engineer, starting and expected completion dates, costs, etc., can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Japanese statistics and trade source estimates.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on Japan is available on a continuing basis from:

Country Marketing Manager—Japan
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Japan." DIB 75-12-505, July 1975.

To compensate for this reduction, alternative sources of energy will have to be developed if the country is to retain its position as an industrial power.

The Industrial Science and Technology Agency of MITI launched a "Sunshine Project" in July 1974 to develop forms of clean energy which would meet the major portion of Japan's energy requirement in the decades ahead. Research and development efforts are being concentrated on four alternatives—solar power generation, coal gasification and liquefaction, geothermal energy, and hydrogen energy. Nearly $7 million was budgeted for these efforts in fiscal 1974, and more than $11 million was allocated in fiscal 1975.

Solar.—Solar energy facilities are still very much in the experimental stage in Japan, and no electricity generating plants have been constructed, nor have any been scheduled for the immediate future. Practical applications of solar energy technology are not expected until the end of the century. By 1990, photovoltaic electrical power systems and systems for heating and cooling buildings should be operational; solar thermal electrical power systems may be operational by the year 2000. All types of U.S.-made solar energy equipment of proven cost and operational feasibility have sales potential in Japan, since very little is currently available from local manufacturers.

Geothermal.—Four geothermal power stations with a combined maximum generating capacity of 68 MW are now operating in Japan. Three additional plants under construction will add 150 MW by 1978. Trade sources predict that the generating capacity from geothermal plants will reach 300 MW in 1980 and 2,060 MW in 1985.

Japanese manufacturers have achieved a sophisticated level of technology in the field of geothermal energy equipment without the aid of foreign technology. Long-term research initiated by MITI includes the following: exploitation techniques such as drilling; methods of generating power from hot water (high-efficiency heat exchangers, binary cycle systems); power generation through direct utilization of volcanic energy; and antipollution methods.

The Government hopes to develop and construct a binary cycle generator with a 50-MW capacity of 1990 and produce equipment capable of generating 100 MW of electricity from volcanic energy by 1996. At present, there is no sales potential for foreign-made geothermal power equipment.

Electrical Energy Systems

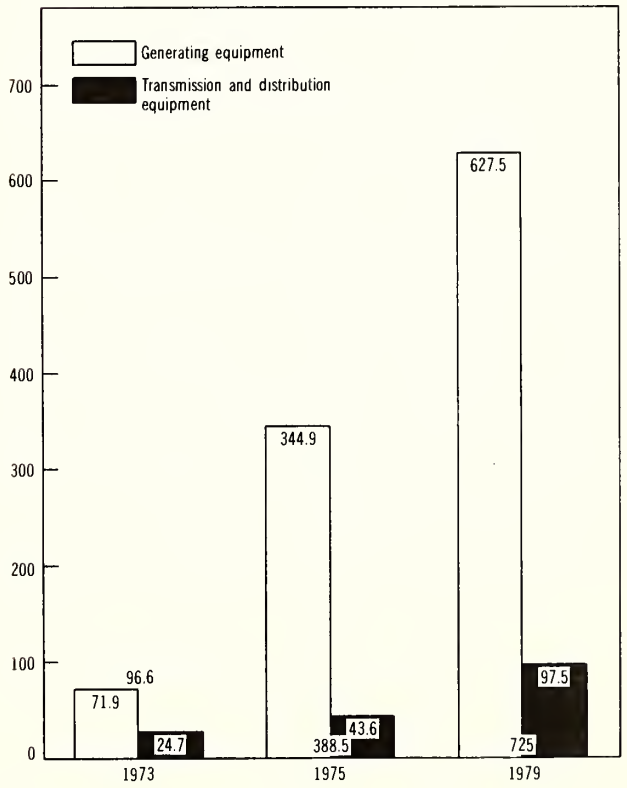
Korea

The market for generation, transmission, and distribution equipment in the Republic of Korea jumped from approximately $96 million in 1973 to over $388 million in 1975 (see table 1 and figure 1). Expansion of generating capacity by the Korean Electric Company (KECO) constitutes the major portion of these equipment investments, which should push the total market to $725 million in 1975.

Korea has ambitious energy plans for the years ahead. These include nuclear power plant construction, major investments in pumped storage systems, major expansion of 345 kV transmission lines and 345/154 kV substation capacity, and an extensive rural electrification program.

Figure 1.—Korea: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Korean statistics and trade sources.

Electric utilities accounted for 83% of all electrical power equipment purchases in Korea in 1974; industry, 10.5%; and Government, about 6.5%. With industrial and government end users becoming increasingly dependent upon KECO for their power, the company is predicted to represent approximately 95% of the future buying potential. KECO is expected to increase its investments in generation equipment at an average of almost 17% per year between 1975 and 1979, while procurement of transmission and distribution equipment is expected to increase at an average 25% annually.

Imports of electrical power equipment from the United States jumped dramatically from just over $21 million in 1973 to almost $50 million in 1974, primarily because of purchases related to Korea's first nuclear power generation plant. U.S.-origin nuclear power reactors, oil-fired thermal power plants, steam generator sets, hydraulic turbine generator sets and pumps, large diesel generator sets, and large transformers are expected to be in particular demand.

U.S. consulting and contracting engineers have been active in designing and constructing electrical power plants and transmission and distribution facilities in Korea. Generally U.S. consultants are preferred because of their technical expertise and because of Korean experience with U.S. technical standards.

Competitive Environment

Korea is virtually 100% dependent upon the im-

Table 1.—Korea: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	59.2	59.4	80.9	335.5	619.0
Transmission and distribution equipment	12.3	15.2	22.0	32.1	78.5
Total	71.5	74.6	102.9	367.6	697.5
Industrial companies					
Generation equipment	7.0	7.5	5.7	5.6	5.0
Transmission and distribution equipment	5.2	6.5	7.2	6.0	10.0
Total	12.2	14.0	12.9	11.6	15.0
Government (other than utilities)					
Generation equipment	4.7	5.0	3.8	3.8	3.5
Transmission and distribution equipment	2.8	3.0	4.0	5.5	9.0
Total	7.5	8.0	7.8	9.3	12.5
Grand Total	91.2	96.6	123.6	388.5	725.0

[1] All figures converted at the following rates: 1972—US$1=W393; 1973—US$1=W399; 1974 and thereafter—US$1=W410.

Source: Korea Electric Company, ROK Ministry of Commerce and Industry, and Bureau of International Commerce, Office of International Marketing research study.

portation of electrical generation equipment, and this dependency is expected to continue for many years. Domestic manufacturers, however, produced more than half of the country's needs for transmission and distribution equipment in 1973-74. Although local production (primarily transformers) is expanding rapidly, it cannot keep pace with the burgeoning Korean demand. Local producers are expected to satisfy only about 45% of the 1979 requirements for transmission and distribution equipment. The major domestic and foreign suppliers of electrical power equipment are listed in table 2.

Imports.—Imports of electrical generation, transmission and distribution equipment increased from less than $82 million in 1973 to about $95 million in 1974 (see table 3). Imports are expected to increase sevenfold between 1974 and 1979, reaching $674 million in 1979.

U.S. suppliers have historically occupied a strong position in the Korean market as a result of local familiarity with American products since the Korean War. Trade sources report that all types of American electrical energy equipment enjoy the highest reputation for quality and durability. In addition to building the first nuclear power plants in South Korea, U.S. firms have been leading suppliers of steam turbine generators, power boilers, diesel generator sets, and a variety of related equipment. Spare parts have been readily available, and the agent of one American firm has even established a diesel engine rebuilding plant in Seoul.

U.S. manufactured equipment made up 26% of all Korean imports of generation, transmission, and distribution equipment in 1973 and jumped to more than 50% in 1974 with the introduction of nuclear energy to Korea. Between 1974 and 1979, imports of generation equipment from the United States are expected to grow from about $49 million to at least $186 million, while imports of U.S.-made transmission and distribution equipment are forecast to increase from $500,000 to $5.5 million. Although overall U.S. imports are expected to increase between 1974 and 1979, the American share in the Korean market is forecast to drop to 18% by 1979 as a result of keen competition from other foreign firms.

Japanese firms, which are expected to continue to predominate in the supply of transmission and distribution equipment, are predicted to increase their share of the much larger generation equipment market from 20% in 1974 to 25% in 1979. They are expected to hold 28% of the overall import market in 1979.

U.K., French and German suppliers also are expected to increase their shares of the market. The portion of the import market supplied by manufacturers in the United Kingdom is forecast to rise from 24% in 1974 to 25% in 1979. French suppliers are expected to achieve a 10% share. The Germans are predicted to gain 5% of the 1979 import market for electrical energy systems.

Financing has become the prime influence on Korean purchases of electrical energy equipment, and trade sources report that suppliers must offer loans in order to make large sales in Korea. Japanese and European suppliers, offering low-interests commercial loans as well as government-to-government loans, are thereby improving their position in the market. Where credit is offered, the Koreans have accepted accompanying stringent requirements for purchase of all materials from the supplying country.

The Government announced in April 1975 that it was seeking $2.15 billion in loans from European countries for a variety of projects. Requests in the electrical power field included the following: from the United Kingdom, $47 million for a 345-kV EHV facility and $458.5 million for a nuclear plant; from France, $37 million for nuclear fuel fabrication and reprocessing, $14.5 million for transmission and substation construction, $43 million for surveying and construction of Imke Dam, and $54 million for construction of a thermal power plant; from Germany, $487.4 million for a nuclear power plant and $42 million for a second thermal power plant at Yeong Dong; from Belgium, $42.7 million for transmission and substation construction and $2 million for nuclear fuel fabrication; and from Italy,

Table 2.—Korea: Major suppliers of electrical power equipment

Domestic manufacturers

Dae Myung Manufacturing
Transformers

New Korea Electric Co.
(Licensee of Osaka Transformers, Japan)
Transformers

Han Yung Industrial Co.
(Licensee of Westinghouse, U.S.)
Transformers, electric motors, pumps

International Electric Enterprise Co., Ltd.
(Licensee of Takaoka, Japan)
Transformers, switchgear
Brown Boveri & Cie. (Switzerland)
HV transformers

In Chun Electric Mfg. Co.
(Licensee of Toshiba, Japan)
Transformers

Kukje Electric Co.
(Licensee of Kokan Mfg. Co., Japan)
Transformers

Lee Chung Electric Co.
(Licensee of Toshiba Co., Japan)
Switchgear, generators, transformers, electric motors, condensors

Tai Han Electric Wire Co.
(Licensee of Tokyo Electric Co., Japan)
Watt-hour meters
(License of Nisshin Electric Co., Japan)
Condensors

Kukje Wire & Cable
(Licensee of Western Electric Co., Japan)
Cables

Union Electric
(Licensee of Mitsubishi Denki, Japan)
Control panels

Dae Han Electric Wire
(Licensee of Sumitomo Electric Co., Japan)
Cables

Hankuk Noble Co.
(Licensee of Teikoku Communication, Japan)
Resistors and rotary switches

Hankuk Machinery Co.
(Licensee of Lummus Co., U.S.)
Heat exchangers

Shin Han Electric Co.
(Licensee of Osaka Transformers, Japan)
Transformers

Sam Yung Electric Industry Co.
(Licensee of Chemical Condenser Co., Japan)
Condensors

Pung Sung Electric Co. Ltd.
(Licensee of Osaki Denki Co., Japan)
Watt-hour meters, converters

Gold Star Communication Equipment
(Licensee of Fuji Musen, Japan)
Watt-hour meters

Gold Star Cable
(Licensee of Hitachi Cable Co., Japan)
Electric wire, cables

United States manufacturers

Westinghouse Electric Co.
Nuclear power plants, switchgear, circuit breakers, transformers, turbine generators

General Electric Co.
Transformers, switchgear, circuit breakers, relays, turbine generators

Combustion Engineering Inc.
Power boilers

Foster Wheeler Corp.
Power boilers

Reliance Electric Co.
Switchgear

Square D Co.
Distribution equipment, controls, panel boards, switchgear

Allis Chalmers Corp.
Transformers, switchgear, circuit breakers

Kohler Co.
Diesel generator sets (50 kW-250 kW output)

Onan Corporation
Diesel generator sets (50 kW-250 kW output)

Caterpillar Co.
Diesel generator sets (up to 1,500 kW output)

General Motors Corp.
Diesel generator sets (up to 1,500 kW output)

Cummins Engine Co.
Diesel generator sets

Ohio Brass Co.
Insulators

I.T.E. Corp.
Motor control centers, circuit breakers

GTE Inc.
Circuit breakers, control circuit relays

Table 2.—Korea: Major suppliers of electrical power equipment—continued

ITT Inc.
Power regulators and boosters

Third-country manufacturers

Mitsubishi Heavy Industries (Japan)
Turbine generators, circuit breakers, power boilers

Hitachi Ltd. (Japan)
Turbine generators, power boilers, switchgear, transformers

Toshiba Ltd. (Japan)
Turbine generators, power boilers, transformers, circuit breakers

Tokyo Electric Co. Ltd. (Japan)
Hydroelectric turbine generator sets, switchgear, circuit breakers

English Electric Ltd., Associated Electrical Industries Ltd. (GEC Ltd.) (United Kingdom)
Turbine generators, switchgear, transformers, circuit breakers, capacitors

Reyrolle Parsons (United Kingdom)
Turbine generators, switchgear, transformers, circuit breakers

Siemens (Germany)
Turbine generators, transformers, power regulators and boosters, switchgear, circuit breakers

AEG (Germany)
Turbine generator sets, power regulators, switchgear, circuit breakers, relays

Alsthom (France)
Turbine generators, switchgear, circuit breakers, transformers

Stein Industrie (France)
Power boilers

Babcock Atlantik (France, affiliated with Babcock and Wilcox, United Kingdom)
Power boilers

Babcock and Wilcox Ltd. (United Kingdom)
Power boilers

ASEA (Sweden)
Transformers, circuit breakers

Fuji Electric (Japan)
Hydraulic turbines, substation equipment

Osaka Transformers (Japan)
Transformers

Nisshin Electric Co. (Japan)
Transformers

Mirrlees Blackstone Ltd. (United Kingdom)
Diesel generators

Niigata (Japan)
Diesel generators

Motoren-Werke Mannheim (MWM) (Germany)
Diesel generators

Deutz (Germany)
Diesel generators

Compteurs Schlumberger (France)
Protection relays

NGK Insulators Ltd. (Japan)
Insulators

Brown Boveri & Cie. (Switzerland)
Switchgear, turbine generators

Source: Bureau of International Commerce, Office of International Marketing research study.

$49.7 million for a 345-kV EHV facility and $12.8 million for increased voltage distribution lines.

European suppliers have recently increased their share of the Korean market by organizing consortia to build power plants. For example, for three Donghae power plants Siemens supplied the turbines and Babcock Atlantik the boilers; at two Honam plants, Alsthom provided turbines and Babcock Atlantik, the boilers; at two Yosu plants, Stein Industrie and Babcock Atlantik supplied boilers and AEI furnished turbines; and at two Inchon plants, Alsthom and Stein Industrie together supplied the needed equipment.

Japanese suppliers have also cooperated, in this way, as at two Inchon plants, where Toshiba provided turbines and Hitachi the boilers.

Trade and technical regulations.—Duty rates for electrical energy systems equipment generally range from 5 to 60%, but some items, including hydraulic turbines, large AC generators, and nuclear reactors, are brought in duty-free. The higher rates of duty are applied on imports of equipment that can be manufactured by local industry.

No technical standards exist for electrical energy equipment in Korea, though American specifications are preferred. Purchasers will accept equipment built to varying standards, depending upon the country of origin.[1] Information on the availability of published standards in Korea may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Trade practices.—Although KECO has used consultants for long-range planning studies, engineering

[1] The standard service voltage in Korea's 200 volt single phase and 380 volt three phase; 100 volt service is also common. Both the metric and British systems of weights and measures are current in the country, but eventual conversion to metric is certain.

Table 3.—Korea: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in millions of U.S. dollars) [1]

	1973	1974	1979
Generation equipment			
United States	20.1	48.8	186
United Kingdom	19.4	22.6	161
Japan	29.5	18.1	155
Germany	1.4	—	31
France	.7	—	62
All others	.7	.9	25
Subtotal	71.8	90.4	620
Transmission and distribution equipment			
United States	1.1	.5	5.5
Japan	6.1	3.4	32.4
United Kingdom	.5	.5	5.5
Germany	2.0	.4	5.5
France	—	—	2.5
All others	.4	.2	2.5
Subtotal	10.1	5.0	54.0
Total			
United States	21.2	49.3	191.5
United Kingdom	19.9	23.1	166.5
Japan	35.6	21.5	187.5
Germany	3.4	.4	36.5
France	.7	.4	64.5
All others	1.1	1.1	27.5
Grand total	81.9	95.4	674.0

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Korean statistics and trade sources.

and construction projects, and for advice on management and operating procedures, it purchases most equipment through suppliers' credits and tied loans. Consultants have limited scope for making recommendations regarding equipment purchases in this end-user sector. In the industrial sector, however, consultants reportedly have greater influence on purchasing decisions. Most Korean engineers have been trained in the United States, and American consultants are preferred because of their technical expertise.

Domestic production.—Although Korean manufacturers produce a range of rectifiers, control panels, circuit breakers, disconnecting switches, and voltage regulators, the most significant locally produced items relating to electrical energy systems are transformers. Total domestic production of transmission and distribution equipment jumped from $15.2 million in 1973 to about $30.6 million in 1975. Domestic manufacture is expected to surpass $50 million in 1979. Most of this production consists of power and distribution transformers.

Exports have increased more rapidly than has production, up from $660,000 in 1973 to $4.6 million in 1975: they are projected to total $7.8 million in 1979. The share of domestic production represented by exports rose from 4% in 1973 to 15% in 1975. The share is projected to drop to 10% in 1976 but climb to 15% again by the end of the decade.

Prospects for growth in domestic production lie in the possible expansion of some existing plants. The Hankuk Machinery Company, built with German credit and technical assistance, is scheduled to begin producing 24,000 diesel engines of 45-256 horsepower annually in 1976. The Chinil Industrial Company also plans to produce diesel engines. Although most present and planned diesel engine production is for marine and pump use, trade sources report that Korean companies could develop the capability to produce diesel engine generator sets. Korean companies which produce power boilers not used in production of electric energy could also develop a capability in that direction.

Local manufacturers of transformers import considerable quantities of components and raw materials. Trade sources report that a typical firm, the Han Yung Industrial Company, a licensee of Westinghouse, estimated that imported components accounted for almost 25% of the factory cost of the company's output in 1974. Silicon steel from Japan represented 10% of the cost; paper and pressboard for insulation represented 5%; ceramic bushings from the United States, 2%; load tap changers from the Westinghouse subsidiary ACEC in Belgium, 5%; and lightning arrestors from Ohio Brass, 2%.

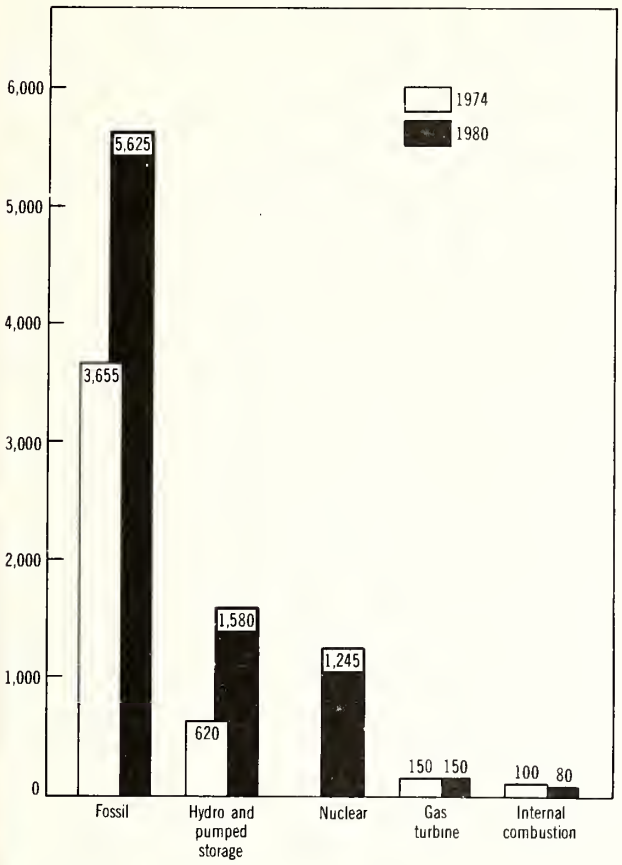
End Users

Electric utilities.—When Korea's electrical generating capacity proved incapable of meeting development objectives during the First Five-Year Plan (1962-1966), investment was poured into power generating facilities. Installed capacity skyrocketed from just under 600 MW in 1964 to about 2,290 MW in 1970. By 1972, total generating capacity had reached 3,870 MW, greatly exceeding the actual demand of 2,100 MW. Thermal installations generated most of this power; the principal source was oil-burning plants, though low-quality coal accounted for about 10% of this production. Nine hydroelectric installations supplied roughly 12% of the total. By 1973, total electric utility generating capacity had risen to 4,270 MW; oil-powered fossil steam plants accounted for 2,705 MW; coal-fired fossil steam plants, 700 MW; hydropower, 620 MW; gas turbine power, 150 MW; and internal combustion power, 95 MW.

Generating capacity climbed to 4,525 MW in 1974 and is projected to exceed 8,680 MW in 1980. (See figure 2 for the breakdown on sources.) Nuclear steam plants are expected to rank with oil-powered fossil steam plants as the leading generating sources by 1985, while pumped storage facilities are

Figure 2.—Korea: Electric utility generating capacity 1974 and projected 1980

(in megawatts)



Source: Korea Electric Company.

expected to provide greater output than hydroelectric power sources.

Total capital expenditures by electric utilities rose from almost $104 million in 1973 to about $195 million in 1974, an 88% increase (see table 4). As a result of the nuclear projects and other major investments, expenditures jumped 188% between 1974 and 1975, from $195 million to almost $562 million. Growth in expenditures by electric utilities is expected to exceed an average annual rate of 16% throughout the remainder of the 1970's. As the basic distribution infrastructure in the country is completed over the next few years, a greater proportion of these moneys will be required to meet increased generation and transmission requirements. Hence, between 1974 and 1980, the proportion of capital expenditures for generation is expected to rise from 43 to 61%, and the share spent on transmission is forecast to increase from 19 to 20%. The proportion spent on distribution is predicted to fall from 38 to 19%.

Table 5 lists the types of equipment bought by the electric utilities from 1972 to the present, as well as those expected to be in demand in 1979. In the largest categories of generation equipment, the market for power boilers is anticipated to show the fastest growth (40% annually) during the remainder of the 1970's. Demand for hydraulic generator sets, though relatively small, is expected to increase at an average rate of 25% per year in 1975-79. Expenditures for nuclear reactors and steam turbine generator sets are nevertheless predicted to remain the highest for any generating equipment in Korea.

Distribution transformers are forecast to continue to represent the largest category for investment in transmission and distribution equipment. Demand for power circuit breakers and large power transformers is expected to increase rapidly, as is investment in control circuit relays.

KECO is the sole public utility in Korea responsible for both electric power generation and distribution. One private electric company, the Kyung-In Energy Corporation, a subsidiary of Gulf Oil Company, and one government organization, the Industrial Sites and Water Resources Development Corporation (ISWACO), generate some power for sale to KECO. Of the total installed power generation capacity in 1973, KECO owned 87%, ISWACO held 5%, and Kyung-In Energy, 8%.

KECO is co-owned (approximately 50-50) by the Government and independent shareholders, with the Ministry of Commerce and Industry retaining authority over its activities. The Ministry of Finance is the usual source of local currency financing for KECO through the Bank of Korea and Korean Development Bank. The Ministry of Construction has jurisdiction over sites for all types of power facilities. ISWACO has responsibility, under the Ministry of Construction, for construction and operation of multipurpose hydro-projects. At present, only one

Table 4.—Korea: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in millions of U.S. dollars) [1]

	1973	1974	1979
Generation			
Fossil	19.8	28.2	206
Nuclear	33.4	51.3	486
Hydro	6.2	.7	—
Pump storage	—	.5	36
Internal combustion	—	.2	—
Total	59.4	80.9	728
Transmission	11.7	37.2	243
Distribution	30.4	74.1	219
Miscellaneous	2.1	2.7	12
Total	103.6	194.9	1,202

[1] For exchange rates, see table 1.

Source: Korea Electric Company, ROK Ministry of Commerce and Industry.

Table 5.—Korea: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	12.4	7.9	11.3	18.1	69.5
Nuclear reactors	13.8	20.3	31.3	168.4	252.0
Turbine generator sets					
Steam	27.3	24.9	36.9	134.8	265.5
Gas	—	—	—	—	—
Hydraulic	5.6	6.2	1.2	12.0	29.0
Motor generator sets					
Diesel	.1	.1	.2	2.2	3.0
Total	59.2	59.4	80.9	335.5	619.0
Transmission and distribution equipment					
Distribution transformers	3.7	7.2	9.9	13.6	27.0
Small power transformers	.4	.5	.6	.8	1.5
Secondary unit substation transformers	.3	.7	1.2	2.4	3.0
Large power transformers	2.1	1.8	5.2	1.0	16.0
Power regulators and boosters	.1	.2	.2	.3	.5
Switchgear	1.5	1.0	1.2	2.1	3.5
Power circuit breakers	3.3	2.7	1.5	9.8	22.5
Control circuit relays	.9	1.1	2.2	2.1	4.5
Total	12.3	15.2	22.0	32.1	78.5

[1] For exchange rates, see table 1.

Source: Korea Electric Company, ROK Ministry of Commerce and Industry; and Bureau of International Commerce, Office of International Marketing research sutdy.

ISWACO plant, consisting of two 100-MW units, supplies power to KECO; eight dams are scheduled to be built during the Third Five-Year Plan (1972 through 1976). In addition, multipurpose projects are planned in the Han, Kum, Nakdong, and Yongsan river basins for that timespan. The 304 MW Yul Do thermal plant operated by the Kyung-In Energy Company sells its entire output to KECO under a 30-year agreement negotiated in 1969.

As of 1975, Korea had no nuclear energy production; construction on its first nuclear power plant at Gori near Pusan is expected to be completed in 1977. A second nuclear project, an expansion of the first plant at Gori, is scheduled for completion in 1980. Both of these plants will have pressurized water type reactors, the first with 595 MW output and the second with 650 MW. Westinghouse is the prime contractor for both projects and will provide the nuclear steam supply system and nuclear fuel for the initial core. English Electric Company and George Wimpey Company are responsible for supplying and installing the electricity generating equipment for the plant.

Korea is to have a third nuclear power plant in operation in 1981 under a 1974 agreement with Canada, which will supply the natural uranium and loans of $560 million for plant construction. This is to be a heavy water reactor plant with 679 MW capacity. The Government has also been negotiating with France for further nuclear projects. Other plans have been proposed for eight more nuclear plants to be completed by 1986 if foreign aid is forthcoming.

The Atomic Energy Commission of the Ministry of Science and Technology has general authority over nuclear matters, and KECO will be the sole user of the energy produced by the nuclear plants. According to trade sources, a Nuclear Power Corporation Law has been proposed to establish a corporation separate from KECO, to be called the Korea Nuclear Company, for the purpose of operating nuclear power plants.

Numerous laws are already on the books to regulate installation and operaiton of nuclear reactors, the handling of nuclear fissionable materials, and compensation for nuclear damages. At the first Gori plant, 1968 U.S. standards regarding radioactivity will be adhered to; hence, higher levels of radioactivity than those now permitted in the United States will be allowed. For subsequent nuclear projects, however, the standards are the same as those currently applicable in the United States.

Korea presently has no capability to construct nuclear power plants; hence, foreign consultants are required for plant design and operation. Korea does have some nuclear mineral resources, but extraction is not now considered economically feasible. Pegmatite and graphite containing small quantities of uranium, as well as monazite placer, have been found in the country.

Although oil price hikes have stimulated Koreans to look toward increasing use of nuclear power for power generation in the future, the Government is nevertheless expected to continue to increase its use of petroleum. Electric power plants will compete with refineries for petroleum. Presently, Korea is entirely dependent upon imports of petroleum, but offshore exploration and drilling rights have been given to four companies. Korea has low-grade coal deposits estimated at perhaps 500 million tons, but the industry is faced with higher labor costs, a need to reach deeper coal deposits, and a problem of modernizing operations. The industry has no plans for coal gasification or liquefaction. There is little chance of Korea's becoming self-sufficient in fuel in the future, and consultants have recommended that the country plan carefully for fuel purchases before building new plants, and build fossil fuel plants capable of being converted from one fuel to another.

Between 1975 and 1980, Korea expects to increase its total electric generating capacity by 4,155 MW, at a cost approaching $1.8 billion. Four of the 12 new or expanded plants will be fueled by oil, one by coal, three by hydroelectric power, two by pumped storage power, and two by nuclear energy. Table 6 gives a breakdown of planned

Table 6.—Korea: Current and planned construction/ expansion of electric power plants, 1975-80 [1]

Type	Number of units added	Total generating capacity added (MW)	Total costs [2] (in millions U.S. $1)
Fossil	7	1,950	475
Hydro	7	960	378 [3]
Nuclear	2	1,245	928
Total	16	4,155	1,781

[1] A detailed breakdown of individual construction projects giving such information as names of contracting engineers, starting and expected completion dates, costs, etc. can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] For exchange rates, see table 1.

[3] Cost estimates for five of the seven units.

Source: Bureau of International Commerce, Office of International Marketing research study.

construction or expansion of electrical power plants for this period.

American-origin equipment with good sales potential for projetcs in Korea includes nuclear powerplants of 600 MW to 800 MW; hydroelectric turbine generators, pumps, and other equipment for pumped storage projects; oil-fired thermal power plants; diesel generator sets of 100 kV to 150 kV for emergency use; lightning arrestors of 22 kV to 345 kV for ungrounded and grounded systems; circuit breakers at 22 kV to 345 kV (bulk oil, air blast, and gas insulated types); 300/400/500 MVA transformers for new 345/154-kV substations; cutout switches; desulfurization equipment; hydraulic turbines; insulators; rectifiers, capacitors; and switchgear of 154 kV and above.

New Technology/Alternative Sources of Energy

KECO officials have expressed great interest in development of combined cycle plants and the first 200 MW-combined-cycle plant is planned to begin operation in 1982. Plans exist for eight more such plants with capacities of up to 600 MW between 1984 and 1995.

The Government has contracted with a French consulting firm to explore the feasibility of using the great tidal changes on Korea's coast for power generation, but no information is available on the findings. The cost for harnessing tidal power in Korea has been estimated as averaging $760 per kW of installed capacity.

Korea also has geothermal resources now used for hot spring resorts at Onyanb and Yuseang, just south of Seoul, and at Dongrae near Pusan. Thus far there are no definite plans for development of either geothermal or solar resources for electricity generation.

In the field of transmission, KECO has long-range plans to install throughout the country a total of 9,800 kilometers (km) of 385 kV lines, plus 345/154 kV substations with a total capacity of 57,000 MVA. Construction is currently underway on 580 km of 345 kV transmission lines and four 500 MVA substations which are scheduled for completion in 1976. The current KECO transmission system includes 9,690 km of 154 kV lines, 10,570 km of 66 kV lines, and 7,950 km of 22.9 kV lines. Installed distribution circuits total 94,570 km.

Underground transmission projects are in progress in Seoul and Pusan; about 37 km of 154 kV underground pipe-type cable is being installed in the Seoul business district.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on South Korea is available on a continuing basis from:

Country Marketing Manager—Korea
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

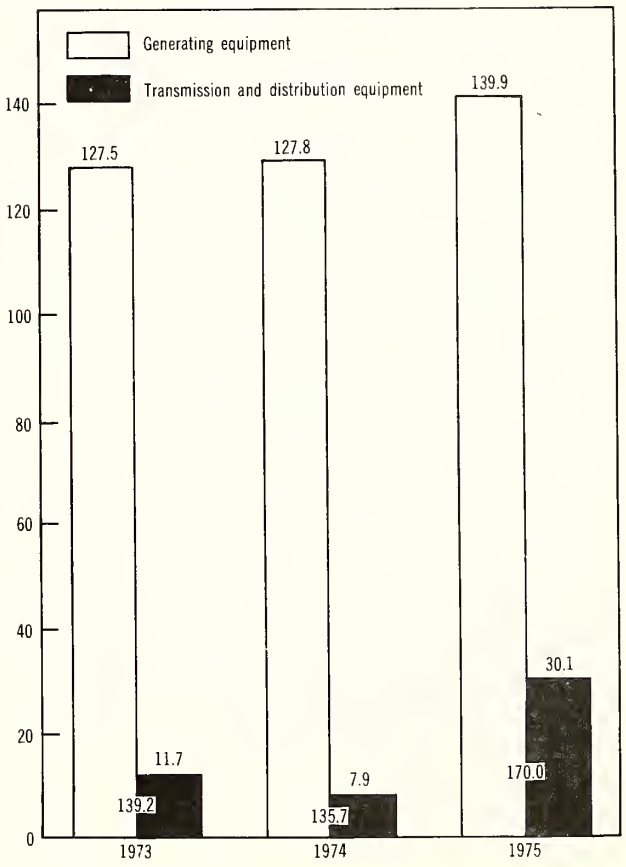
National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electric Energy Systems: Korea." DIB 76-03-501, August 1975.

Electrical Energy Systems
Mexico

As the Mexican Government works to rationalize its power supply authority and meet energy demand constantly running ahead of generating capacity, the Mexican market for electrical generation, transmission and distribution equipment is expanding at a healthy if uneven rate. Purchases rose from $119 million to $170 million in the 1972-75 period [1] (see table 1). Generation equipment accounted for over 80% of the market, with a value of $140 million in 1975 compared to $109 million in 1972. Purchases of transmission and distribution equipment totaled $30 million in 1975.

Figure 1.—Mexico: Orders placed for electrical power equipment, 1973–75
(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Mexican statistics and trade source estimates.

The national utility, the Federal Electricity Commission (CFE), accounts for over 90% of the total market. CFE's purchases vary widely from year to year. They rose steadily in the early 1970's but this growth was interrupted by a market slump in 1973-74. The utility resumed its large orders the following year, so that its outlays for equipment exceeded $155 million in 1975—$127 million for generation equipment and $28 million for transmission and distribution equipment. The utility's planned investments in new plants is expected to sustain the market growth for both generation and transmission and distribution equipment for the next 10 years.

Industrial demand, which accounts for less than 10% of the market, grew substantially during the 1972-75 period; equipment purchases reached $13 million in 1975. The government sector, excluding utilities, constitutes only about 1% of the market.

Sales opportunities for generation equipment are expected to be led mainly by steam and hydraulic turbine generator sets and power boilers. Nuclear power systems will gain prominance in the market until the 1980's. Switchgear and transformers offer the greatest transmission and distribution equipment sales prospects.

Sales from the United States totaled $45 million in 1974 and are forecast to reach at least $47 million in 1979. Opportunities for U.S. suppliers are greatest in generation equipment, where potential sales for U.S. goods are estimated at $43 mililon in 1979.

The introduction of nuclear power plants during the late 1970's will add a new dimension to the electrical energy systems market in Mexico. Nuclear

[1] Purchases for any given year reflect orders placed in that year rather than actual disbursements.

Table 1.—Mexico: Estimated value of orders placed [1] for electrical power equipment by major end-user sectors, 1972-75

(in millions of U.S. dollars)[2]

	1972	1973	1974	1975
Electric utilities				
Generation equipment	103.4	116.6	116.1	127.1
Transmission and distribution equipment	8.0	10.0	6.0	28.1
Total	111.4	126.6	122.1	155.2
Industrial companies				
Generation equipment	5.0	9.7	10.5	11.5
Transmission and distribution equipment	1.4	1.5	1.7	1.8
Total	6.4	11.2	12.2	13.3
Government (other than utilities)				
Generation equipment	1.1	1.2	1.2	1.3
Transmission and distribution equipment	.2	.2	.2	.2
Total	1.3	1.4	1.4	1.5
Grand Total	119.1	139.2	135.7	170.0

[1] Purchases for any given year reflect orders placed in that year rather than actual disbursements.

[2] All figures converted at the following rate: 1972 and thereafter—US$1 = 12.49 pesos.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Mexican statistics and trade source estimates.

power is expected to become the nation's chief energy source within two decades though the utilities intend to utilize other energy sources, including hydro, and geothermal installations. They also plan to make greatest use of coal in conventional steam generation plants and are evaluating combined cycle systems.

Competitive Environment

Mexico's electrical power equipment market has attracted many important manufacturers, and competition for sales is lively (see table 2). Imports have supplied between 50 and 60% of the total market in recent years, and should continue to hold a major portion of the remainder of the 1970's. They are likely to gain an even larger market share during the 1980's as the country moves to more complex energy systems, including nuclear technology.

Imports.—Mexico's imports of electrical power equipment totaled $83 million in 1973, declined during 1974 to $68 million, but should rise again to exceed $90 million by 1979 (see table 3). The 1974 decline is partially attributable to utility budget cutbacks during Mexico's recession in 1971-72, a time when most purchase decisions and equipment orders were made for the deliveries in 1974.

Generation equipment accounts for over 80% of total equipment imports. Such imports should climb from a 1974 level of $55 million to nearly $86 million in 1979. Imports of transmission and distribution equipment vary much more than generation equipment from year to year; domestic manufacturers, furthermore, are expected to take a growing share of this business as they produce more technically advanced equipment for local consumption and exports.

U.S. suppliers provide about half of Mexico's imports of electrical power equipment. Sales of American equipment consist chiefly of steam and gas generator sets, nuclear reactors, transformers, and switchgear. Power equipment imports from the United States are forecast to reach about $47 million in 1979, as U.S. suppliers maintain their import share in spite of increasingly strong competition from third-country sources.

Good technical quailty and reliable supplies of spare parts are primarily responsible for the good sales record of U.S. power equipment manufacturers in Mexico. Price stability has also been an advantage enjoyed by U.S. suppliers, who maintain more predictable pricing policies than their foreign competitors.

Japanese firms have won several major generation equipment contracts in recent years, and imports from them are forecast to reach about $14 million in 1979. Japanese suppliers have been particularly successful selling gas and steam turbine generator sets, hydraulic turbines, and alternators to the utility sector. They have been less active in the transmission and distribution equipment market, and their annual sales of this equipment are expected to remain around $1 million through 1979.

Japanese suppliers sell advanced equipment at competitive prices, and often offer lower interest rates than competitors for long-term financing on major equipment purchases.

British, Swedish and German manufacturers have been the chief European competitors in the generation equipment market. German and Swedish firms also sell transmission and distribution equipment; they have developed small but stable markets in Mexico for their transformers, circuit breakers, and switchgear.

Trade and technical regulations.—Imports of electrical power equipment are generally subject to customs duties ranging from 10 to 53%, with rates of 20 to 35% applicable to most equipment. Preferential duties apply to imports of some equipment from member nations of the Latin American Free Trade Area and the Andean Pact. Import licenses are generally required.

Technical requirements and specifications [2] are established for individual projects or contracts and are not standardized. Nor are there specific labeling requirements to which imported equipment must

[2] The electrical power supply characteristics in most areas of Mexico are 110/220 volts, 60 hertz, single or 3-phase. The metric system of weights and measures is the statutory standard.

Table 2.—Mexico: Major suppliers of electrical power equipment

Domestic manufacturers

Manufacturera Fairbanks Morse, S.A. (subsidiary of Fairbanks Morse, U.S.)
Generation equipment: single-phase AC, single-phase light plant, and three-phase generators; internal combustion plants for lighting; specialized generator groups. Transformers: dry-type, distribution and lighting transformers, and autotransformers

Sociedad Electro-Mecanica S.A. de C.V. (licensee of Electric Machinery/Cleaver Brook, U.S.)
Generation equipment: Specialized generator groups, three-phase generators, and power boilers. Switchgear: power and control panels for generating plants; distribution, automatic alternate control, emergency plant control panels; circuit breakers; disconnecting knife switches; and high tension safety interrupters.

Kohler de Mexico, S.A. de C.V. (subsidiary of Kohler, U.S.)
Generation equipment: internal combustion plants for lighting, single-phase AC and single-phase light plant generators

Miller de Mexico, S.A.
Generation equipment: light plant generators with internal combustion engines

Inductomex, S.A.
Generation equipment: specialized motor generator groups

Conductores Monterrey (licensee of McGraw Edison, U.S.)
Transformers: control, current, and power; dephasing, rectifying, and specialized transformers; runway lighting; distribution and lighting transformers; underground lighting; variable autotransformers, and cables

Electrotecnica Balteau S.A.
Transformers: power, current, dephasing, and specialized

Industrias IEM, S.A. de C.V. (licensee of Westinghouse, U.S.)
Transformers: distribution and lighting, power, cooling, dry type distribution, dephasing, rectifying transformers for underground lighting and distribution, power transformers with forced air and oil cooling; and autotransformers. Switchgear: regulation and control systems, alternative automatic command panels, power and control panels for generator plants, high- and low-tension distribution panels, interrupters in oil, and electromagnetic interrupters

General Electric de Mexico, S.A. (subsidiary of General Electric, U.S.)
Transformers: distribution and lighting, underground distribution and lighting, control, rectifying, dry type distribution, specialized, and power transformers with forced air and oil cooling. Switchgear: protection, control and measurement thermomagnetic interrupters; automatic command, distribution switchboards; power and control panels for generating plants; disconnecting knife, oil switches; and control relays

Industrias Sola Basic, S.A. (subsidiary of Sola Basic, U.S.)
Transformers: dry-type, control and rectifying, specialized, and autotransformers

Cutler-Hammer Mexicana, S.A. (subsidiary of Cutler-Hammer, U.S.)
Switchgear: selective, thermomagnetic interrupters; emergency plant controls; knife switches; relievers; and control cabinets

Balmec, S.A. (licensee of General Electric, U.S.)
Switchgear: Capacity and control panels and potency factor indicators

Brown-Boveri Mexicana S.A. de C.V. (subsidiary of Brown-Boveri, Switzerland)
Switchgear: lighting and motor, emergency plant controls; automatic and nonautomatic interrupters; power and control panels for generating plants; distribution, automatic control, capacitor-equipped panels; compressed air interrupters (high tension), thermal overcharge relievers; disconnecting knife switches; and busways

Square D de Mexico S.A. (subsidiary of Square D, U.S.)
Switchgear: automatic alternative command panels; emergency plant controls; power and control panels for generating plants; automatic start-up control transference and stopping panels for emergency plants; knife switches; and disconnecting, thermomagnetic, multicontact, control and measurement selector interrupters

Honeywell de Mexico, S.A. (licensee of Honeywell, U.S.)
Switchgear: all types of control panels

Ce-Rrey (subsidiary of Combustion Engineering, U.S.)
Generation equipment; power boilers. Switchgear: all types of control panels

Babcock and Wilcox de Mexico, S.A. (subsidiary of Babcock and Wilcox, U.K.)
Generation equipment: power boilers

Clayton de Mexico, S.A.
Generation equipment: power boilers

Metalver, S.A.
Generation equipment: power boilers

U.S. manufacturers

General Electric
Gas turbine, steam generator sets; power distribution transformers; nuclear reactors; switchboards; protection relays for switchboards; and circuit breakers

Westinghouse
Gas and steam generator sets, power and distribution transformers, switchgear, and feedwater heaters

Worthington
Diesel and steam generator sets, condensers, water circulation pumps, and deaerators

Byron Jackson
Feedwater, water circulation, and condensation pumps

Honeywell
Control valves

Table 2.—Mexico: Major suppliers of electrical power equipment (Continued)

Combustion Engineering
Auxiliary boilers and steam generator sets

Pfaudler Permutit
Demineralizing plants

Key Pipe and Supply
High pressure valves

Fisher Governor
Control valves

Pratt Whitney
Gas turbine mobile plants

Third-country manufacturers

Mitsubishi (Japan)
Gas and steam turbine generator sets; hydraulic turbines; alternators; diesel plant and battery, protected switchboards; and power, current transformers

Itoh (Japan)
Gas and steam turbine generator sets; water circulation pumps; high pressure, control valves; hydraulic turbines; alternators; and relays

Tokyo Shibaura (Japan)
Thermo generator sets

Escher Wyss GmbH (Germany)
Hydraulic, and steam and gas turbines

Sprecher and Schuh (Germany)
Power and current transformers, power circuit breakers, knives, and knife switches

Babcock and Wilcox Ltd. (United Kingdom)
Steam generator sets and deaerators

English Electric (United Kingdom)
Mobile diesel plants

British Insulated Cables (United Kingdom)
Busways

Allmanna Svenska (Sweden)
Lightning rods, knife switches, power transformers, and alternators

Comp. Electrotecnica Italiana (Italy)
Busways

Source: Bureau of International Commerce, Office of International Marketing research study.

conform by law. Information on the availability of published standards in Mexico may be obtained from The National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Prospective bidders or their local representatives must register with the Ministry of National Properties (Secretaria del Patrimonio Nacional) and with the Federal Electricity Commission (CFE). Bidders for utility contracts should also be prepared to submit financing terms for at least 50% of the equipment costs. CFE usually requires presentation of a specific financing plan either by the supplier or a financial institution for purchases up to $1.5 million, while the financing of larger purchases from U.S. suppliers is generally arranged through the Export-Import Bank and commercial banks.

Trade practices.—Industrial users of electrical power equipment frequently call upon consulting and contracting engineers to design facilities and to recommend power equipment, but they seldom give these engineers authority to make equipment purchases. Although at one time CFE depended heavily on consulting and contracting engineers for purchasing electrical power equipment as well as designing power plants, engineers no longer play a role in CFE's equipment purchases.

Domestic production.—Mexican production of electrical power equipment totaled $67 million in 1974, representing an increase of about $10 million over the preceding year. The industry consists of 45 firms, 10 of which specialize in generation equipment. Some large companies have product lines which include both types of equipment. Most of the manufacturers are subsidiaries or licensees of major foreign equipment suppliers.

Five domestic manufacturers provide most of the power boilers used in the country with sales being dominated by two: Ce-Rrey and Babcock and Wilcox, which together supply about 60% of that market. Some components for highly specialized power boilers are imported, but otherwise local manufacturers use Mexican-made parts.

Generators with capacities of 500 kW are manufactured locally. Manufacturera Fairbanks Morse is the country's largest producer in this field, accounting for over 40% of sales. Other important suppliers include Sociedad Electro-Mecanica, Kohler, and Miller, which together provide about 35% of domestic production. About half the parts used in local production are imported.

Power and distribution transformers are manufactured by 15 firms. The output of two, Industrias IEM and Electrotechnica Balteau, typically accounts for more than 40% of sales while three others (Conductores Monterrey, General Electric de Mexico, and Industrias Sola Basic) are generally considered by market sources as together accounting for another 40% of the total. Over 95% of the components used by domestic transformer manufacturers are of Mexican origin.

Switchgear is manufactured by 20 companies; no single firm dominates sales. Subsidiaries of three U.S. companies (Square D, General Electric, and Cutler-Hammer) account for about half of domestic production while the Mexican subsidiary of Brown-

Table 3.—Mexico: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in millions of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	31.3	36.9	42.6
Sweden	1.9	2.8	4.7
Japan	14.8	.6	12.8
Germany	—	—	8.5
All others	23.4	14.1	16.6
Subtotal	71.7	55.0	85.2
Transmission and distribution equipment			
United States	7.2	8.1	4.1
Germany	1.7	1.7	1.0
Japan	.5	1.1	1.0
Sweden	.3	.2	.3
All others	1.8	2.2	.4
Subtotal	11.5	13.3	6.8
Totals			
United States	38.5	45.0	46.7
Sweden	2.2	3.0	5.0
Germany	1.7	1.7	9.5
Japan	15.3	1.7	13.8
All others	25.5	16.9	17.0
Grand Total	83.2	68.9	92.0

[1] For exchange rates, see table 1.

Source: Bureau of International Marketing research study. Values based on official Mexican statistics and trade source estimates.

Boveri (Switzerland) contributes approximately 20%.

Trade sources anticipate growing volume and greater technical sophistication in local power equipment production during the next 10 to 15 years. Domestic manufacturers are expected to boost the capacity of their generators above the 500-kW level and to incorporate more advanced technology in transformers and switchgear with a view toward gaining a larger share of the domestic market and expanding export sales.

Exports of electrical power equipment include high tension cables (up to 100 kW), capacitors, condensers, electromagnetic switches, circuit breakers, AC single-phase generators for lighting (both with and without internal combustion engines), and control and dephasing power transformers. In 1974 local manufacturers registered their first export sales of distribution and lighting transformers and thermomagnetic switches with high interrupting capacity (up to 200 kW).

The market for imported components and instrumentation among equipment manufacturers is small. Components currently imported include condensers (1.2 to 23 kW and 69 to 115 kW), specialized AC generators (300 to 500 kW), diesel engines (500-800 hp), and thermostats. Generator manufacturers are the main purchasers. The Government accords domestic component suppliers an advantage of 15% of the c.i.f. cost of imported items on bids for CFE contracts; the import price against which local bids are compared includes import duties, even though CFE is entitled to rebates of 75 to 100% on duties. Moreover, domestic firms in which Mexicans hold a controlling interest (51%) are not required to submit financial terms with bids on CFE contracts when locally produced components constitute at least 60% of the equipment cost.

End Users

Electric utilities.—Mexico's utilities plan huge capacity expansions during the next 10 years. By 1980 they expect to double the 1975 generating capacity of 10,411 MW; additional power plants slated for completion in the 1980-85 period will add almost another 10,000 MW, bringing total capacity to 30,731 MW in 1985.

Capital expenditures for the industry totaled over $135 million in 1974 and are expected to reach $256 million in 1980 and $350 million in 1985 (see table 4). Investments in generating facilities will rise from $127.9 million in 1974 to $233 million in 1980. Investments for transmission and distribution should rise from a 1974 level of $7.8 million to well over $20 million in 1980.

Mexico's utilities are nationally owned. The Federal Electricity Commission (CFE), which is a federal agency, is the principal utility; it owns or holds a controlling interest in some 20 electrical power companies, among the largest of which is the Compania de Luz y Fuerza del Centro. CFE is directly responsible for more than 250 power plants and provides about 90% of the nation's electricity.

Originally established as an electrical power company in 1937, CFE was given exclusive authority in 1960 over all generation, transmission and distribution of electrical energy as a public service. It is administered by a five-member board: the Minister

Table 4.—Mexico: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in millions of U.S. dollars)[1]

	1973	1974	1980
Generation			
Fossil	82.3	108.0	42
Nuclear	—	—	171
Hydro	34.2	9.3	12
Gas turbine	1.5	—	—
Internal combustion	9.2	6.1	8
Geothermal	—	4.5	—
Total	127.2	127.9	233
Transmission and distribution	11.7	7.8	23
Grand Total	138.9	135.7	256

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Mexican statistics and trale source estimates.

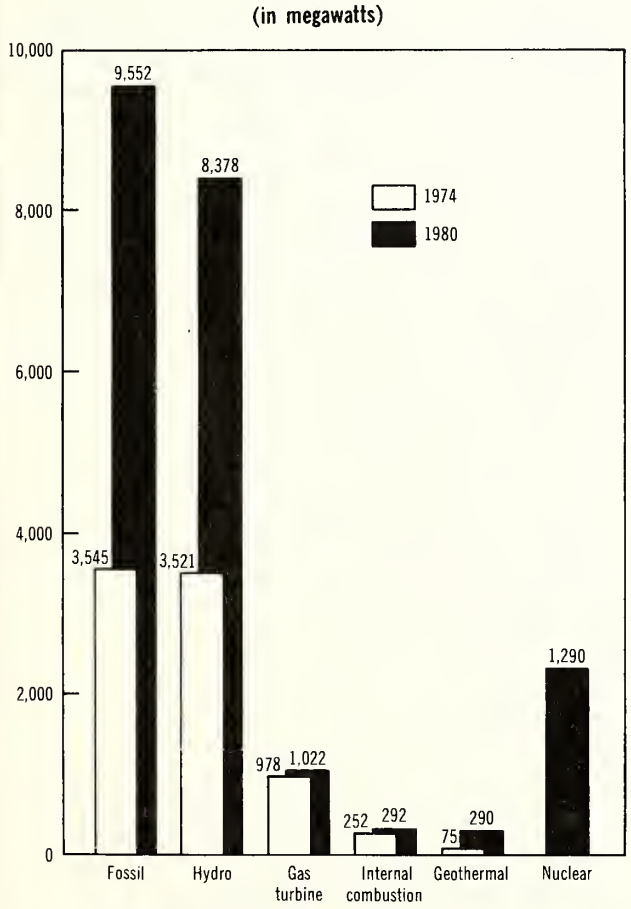
of Industry and Commerce who presides, three members appointed by the President (upon recommendations from the Ministries of Hydraulic Resources, Finance, and Industry and Commerce), and the Director General of the Mexican Development Bank (Nacional Financiera, S.A.). Most civil engineering work on power stations and transmission lines is carried out by CFE itself; dams for hydroelectric projects are built by the Ministry of Hydraulic Resources.

Fossil fuel steam and hydropower plants provided 86% of CFE's generating capacity in 1975. Over the next 5 to 10 years, the utility plans to significantly augment the capacity of such plants, but it will also move to other power sources, most notably nuclear technology (see figure 2 and table 5).

Investments in new steam generating plants are expected to remain at high levels throughout the 1970's and into the 1980's, but further development of conventional steam power plants will be restricted by rising fuel oil costs [3] and the nation's limited coal resources. During the next several years, however, exceptional power equipment sales opportunities will be created by the 4,549-MW increase in fuel oil and 920-MW increase in coal generating plant planned for 1975-80; combined cycle systems are also expected to add to steam plant capacity. Major equipment purchases for new fuel oil-fired power palnts include one 300-MW unit in Manzanillo scheduled for 1979 and another slated for 1980; meanwhile, one 300-MW unit will be added to the Mazatlan power plant in 1978. New coal-fired plants in Rio Escondido will require two 160-MW generators in 1978 and two 300-MW units in 1980, while major equipment purchases (including three 300-MW units) will be made for new coal-fired plants scheduled to begin operations during the early 1980's in Coahuila. Investments planned through 1985 will bring total steam generating capacity to 11,500 MW, of which 2,000 MW will be provided by coal.

Rising fuel oil costs have led CFE to plan significant purchases of hydro generation equipment during the next 5 years for a series of major power plants. Hydro capacity was 4,123 MW in 1975, another 4,255 MW will be added during 1976-80, and an additional 1,000 MW are scheduled for 1982-83. The largest new hydro project is Chicoasen in the State of Chiapas, where six 300-MW units will be put in operation during 1979; the total cost of this project is estimated at some $640 million. Other major hydro equipment purchases include four 100-MW units for Penitas in 1979 and three 180-MW units for Aquamilpa in 1982. Further hydro potential is limited, however, as most of the accessible natural resources will be utilized in the

Figure 2.—Mexico: Electric utility generating capacity, 1974 and projected 1980



Source: Comisión Federal de Electricidad.

Table 5.—Mexico: Current and planned construction/expansion of electrical power plants, 1975-83 [1]

Type	Number of units added	Total generating capacity added (megawatts)
Fossil	37	8,107
Hydro	39	5,856
Nuclear	4	2,790
Geothermal	6	325
Gas turbine	3	58
Internal cumbustion	15	39
Total	104	17,175

[1] A detailed breakdown of individual construction projects giving such information as name of contracting engineer, starting and expected completion date, costs, etc. can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Mexican statistics and trade source estimates.

[3] Although CFE currently buys fuel oil at subsidized prices from Pemex, government policy favors eventual withdrawal of this subsidy, and CFE is taking trends in international oil prices into account in making its long-range plans.

projects planned through the early 1980's, and creation of artificial hydro sites would require flooding agricultural lands. The National Government does not presently favor developing artificial sites; consequently, spending for new hydro power plants is expected to diminish during the 1980's.

Nuclear technology is viewed by CFE as the long-term solution for Mexico's electricity supply. Capital investments in nuclear power plants are expected to reach $171 million in 1980 and $240 million in 1985.

The first nuclear power plant, Laguna Verde, is scheduled to begin operations during 1979; this project will consist of two 645-MW units, with the second unit scheduled to begin operating in 1980. The reactors for Laguna Verde are light water, uranium enriched. They were purchased from Westinghouse, while the turbines are of Japanese origin. The cost of this equipment was approximately $50 million.

CFE has two more nuclear plants planned for 1983; each will comprise one 750-MW unit. One plant will be located in the Bajic area and the other in the central part of the country. CFE is considering use of heavy water with natural uranium in these plants, but the type of reactors to be purchased will depend on the feasibility of producing heavy water in Mexico. Trade sources report CFE favors making future nuclear power equipment purchases from a single source, as a package which includes long-term financing.

Nuclear generating capacity is projected by CFE at 1,290 MW in 1980 and 6,440 MW by 1985, with the output of nuclear plants rising from about 1% of total generating capacity in 1980, to more than 20% by 1985, and over 50% in 1995.

Geothermal energy sources are also being utilized. Development of these resources presently is concentrated in areas near the U.S. border. Two 37.5-MW plants, located in Cerro Prieto (near Mexicali), are already in operation, and three more are slated to become operational in this same location in 1977-78, serving Tijuana, Tecate, Mexicali, and Ensenada. Some 325 MW of new geothermal capacity are planned for Cerro Prieto in the 1975-83 period.

Combined cycle power systems are new to CFE operations. The first plant was established in 1974 in Dos Bocas (134 MW); two more plants (100 MW and 234 MW) were added in Dos Bocas and one (204 MW) in Torreon in 1975. CFE is currently evaluating this technology with a view to using these systems in place of conventional steam plants. Total combined cycle capacity is projected at 538 MW in 1980.

Steam and hydraulic turbine generator sets and power boilers will represent a substantial portion of CFE's equipment budgets throughout the 1970's and into the 1980's (see table 6). Equipment associated with nuclear power generation systems will assume growing importance during the late 1970's and will represent the prime long-term market. Other types of generation equipment, particularly gas turbine and diesel motor generator sets, are purchased by CFE for emergency applications. CFE generally buys about 10 small (about 150-kW) diesel mobile plants each year; it also has more than 40 large (500- to 2,500-kW) diesel plants, and trade sources anticipate five more of these units will be purchased during 1976. Also to be purchased during 1976 are two mobile gas turbine plants (18 MW to 20 MW); CFE presently has four or five of these plants. Most of CFE's orders for generation equipment are placed 3 years before a plant is scheduled to come into operation.

Spending for transmission and distribution equipment is forecast to remain at high levels during 1975-85 because of the volume of new power plant construction and expansion of the national power service network. CFE's expenditures for this equipment reached a record high of $28 million in 1975, including $19.6 million for transformers. Expenditures for other types of equipment were up also, as purchases of switchgear in 1975 surpassed $4 million and power circuit breakers, $2 million.

Most favorable sales prospects for U.S. suppliers

Table 6.—Mexico: Estimated equipment expenditures by electric utilities, 1972-75

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975
Generation equipment				
Power boilers	17.8	23.5	36.0	18.0
Nuclear reactors	—	—	—	80.0
Turbine generator sets				
Steam	63.2	54.8	72.0	29.1
Gas [2]	.6	1.5	—	—
Hydraulic	18.1	33.1	8.1	—
Diesel generator sets	3.7	3.7	—	—
Total	103.4	116.6	116.1	127.1
Transmission and distribution equipment				
Distribution transformers	1.6	2.0	1.2	5.6
Small power transformers	.8	1.0	.6	2.8
Secondary unit substation transformers	1.2	1.5	.9	4.2
Large power transformers	2.0	2.5	1.5	7.0
boosters	.4	.5	.3	1.4
Switchgear	1.2	1.5	.9	4.2
Power circuit breakers	.6	.7	.4	2.0
Control circuit relays	.2	.3	.2	.9
Total	8.0	10.0	6.0	28.1
Grand Total	111.4	126.6	122.1	155.2

[1] For exchange rates, see table 1.

[2] Includes combined cycle power systems.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Mexican statistics and trade source estimates.

will include: mobile diesel (500-2,500 kW) and gas turbine (5,000-18,000 kW) plants, inertial fly wheel generator sets (about 350 kW), steam generator sets (over 500 kW), alternators, synchronous reactors, deaerators, desalination equipment, and desulfurization equipment. Also expected to offer good potential are: specialized transformers, disconnecting knife switches, lightning rods and arresters, substation equipment, boric acid fuses, insulators, thyristors, and combustion control equipment.

Industrial end users.—About 10% of Mexico's electricity is generated by some 2,300 plants with private or mixed private and public ownership; generating capacity in these plants totaled 1,590 MW in 1973. Hydro plants accounted for 80 MW, steam and internal combustion units for most of the remaining generating capacity.

Approximately 100 industrial plants are capable of producing more than 2,000 kW, and around 40 have generating capacities in excess of 5,000 kW. Most of the plants producing more than 2,000 kW are conventional steam generating facilities located in mines, petrochemical complexes, and sugar refineries; some are also installed in paper and cement factories and in other types of large industrial complexes. The majority of industrial power installations, however, are small; around 2,000 plants have capacities of less than 500 kW. Most of these small plants use diesel generators.

Industrial spending for electrical power equipment totaled $13 million in 1975, accounting for about 8% of the market. Purchases of generation equipment displayed exceptional growth, increasing from $5 million to $11.5 million during 1972-75. Industry's demand for electrical power equipment is expected to mount steadily during the remainder of the decade and could provide a market of about $19 million in 1979.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on Mexico is available on a continuing basis from:

Country Marketing Manager—Mexico
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

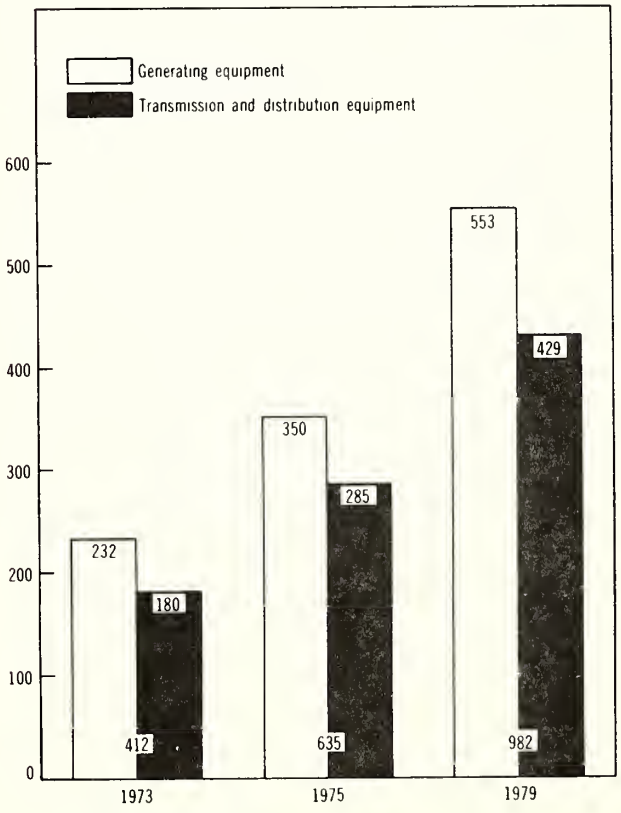
The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Mexico." DIB 76-01-504, August 1975.

Electrical Energy Systems
Netherlands

Heavily industrialized and densely populated, the Netherlands must accommodate strong environmentalist and conservationist pressures before it can either build nuclear power stations or otherwise significantly expand its power supply. As a consequence, prospects for growth in the Dutch market for electrical energy generation, transmission and distribution equipment will probably remain dependent on conversions of boiler plants from one type of fossil fuel to another, and on temporary measures, such as the acquisition of peak load-breaking equipment.

Figure 1.—Netherlands: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Dutch statistics and trade source estimates.

Expenditure on electrical power equipment increased from $351 million in 1972 to $635 million in 1975 (see table 1 and figure 1). The growth catalyst was the 1973 Arab embargo on oil, which in depriving 40% of the power plants in the Netherlands of fuel, accelerated a trend toward the use of domestic natural gas that had been discovered during the previous decade. As of 1975, oil had been phased out entirely, and 85% of the Dutch electricity supply was gas fueled.

Presently, however, conversions back to imported oil and imported coal are in view, due to a 1975 conservationist decision of the State Gas Organization (the controller of the resource) to terminate sales to power companies over a period extending to 1984 by declining to renew the 10-year contracts as they expire. This shift is expected to stimulate further expansion of the electrical energy systems market between 1975 and 1979, to a level in excess of $980 million in 1979.

Approximately 20 contracting engineering firms—many of them from the United States—operate in the Netherlands. These firms are primarily associated with the chemical and petrochemical industries and have been able to freely introduce into plant designs new U.S. electrical power equipment, control circuitry, metering, and alarm systems.

Specifications for power station tenders, which are usually awarded as a package, are prepared by the Approval Board for Electra-Technical Materials (KEMA), the industry-sponsored standardizing and testing institution. The power plant plus some distribution panels and perhaps some distribution transformers with incoming circuit breakers are generally included in the package plan. Private contracting

Table 1.—Netherlands: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	164	189	253	300	500
Transmission and distribution equipment	130	160	200	260	400
Total	294	349	453	560	900
Industrial companies					
Generation equipment	35	38	40	43	45
Transmission and distribution equipment	15	17	20	22	25
Total	50	55	60	65	70
Government (other than utilities)					
Generation equipment	5	5	6	7	8
Transmission and distribution equipment	2	3	3	3	4
Total	7	8	9	10	12
Grand total	351	412	522	635	982

[1] All figures converted at the following rates: 1972—US$1 = f.3.21; 1973—US$1 = f.2.81; 1974 and thereafter—US$1 = f.2.79.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Dutch statistics and trade source estimates.

firms are only on occasion called upon to design or place orders for KEMA.

Competitive Enironment

Well integrated into the European Economic Community (EEC), the Netherlands uses domestic, German, and other European electrical energy equipment (see table 2). Domestic suppliers predominate locally and supply a large export market. However, the large Dutch manufacturers must often order complementary equipment and subassemblies from other European and multinational producers. Major projects typically involve foreign and domestic firms.

Imports.—In the absence of major projects, the import level is forecast to remain relatively low for the next few years. Based on a 1974 value of $32.6 million, imports are projected to expand to about $41 million in 1979, with generating equipment accounting for 40% of the total (see table 3).

Germany is expected to remain the principal foreign supplier of electrical power equipment, as well as of components and subassemblies for original equipment manufacturers. Purchasers of German power equipment are predicted to reach $17 million in 1979, representing an import share of 42%, slightly higher than in 1974.

Current market trends also indicate that the French position should improve somewhat, with a 21% share of the import market predicted for 1979, representing a value of $8.7 million. By contrast, purchases from the United Kingdom and Switzerland will probably decline.

The short-run prospect for U.S. manufacturers is for retention of their 5% share of generation equipment imports and 2% share of total power equipment imports. There is potentially a significant market for gas turbines. Some 80 distributors who used to have generating stations have now closed them and buy power. Because the price of power has increased, some of these distributors are considering installing peak-breaking gas-turbines in their old power stations. In view of the trouble that the German firm KWU has had with gas-turbines and the lack of interest in France concerning these units, there is a clear case for U.S. companies to follow up the market potential.

An important factor that favors European producers is the existence of strongly established supply patterns between specific utilities and specific manufacturers. In the small, closely knit business community of the Netherlands, utility directors and the representatives of principal suppliers (including agents for other European producers) are often well acquainted; also, most utility engineers have acquired, over long periods of time, special familiarity with products of one or two manufacturers and tend to purchase their equipment habitually.

Turbogenerators and turboalternators above 440 MV have been supplied principally by Kraftwerke Union (KWU, Germany), Alsthom (France), and less frequently by Brown-Boveri & Cie (BBC, Switzerland) and ACEC (Belgium). KWU also supplied the 469 MW experimental nuclear station. Such equipment is not manufactured domestically.

The market for transformers and switchgear is highly competitive, and imports must compare favorably with domestic products. Imports come from a variety of manufacturers including the German firms, ASEA-Lepper, Trafo-Union, and BBC Mannheim (German subsidiary of the Swiss manufacturer); the Belgian firms ACEC and Pauwels; CEM (France); and Elin (Austria). Although each of these companies manufactures to different specifications, sales typically consist of indoor-type, roller-mountcd, folded-tank, 3-phase transformers of 13 kVA/380 volts (V), 50 hertz, fitted with conservators. Selection is usually determined on the basis of price as it relates to copper-loss, iron-loss, and temperature-rise at full load.

The principal foreign suppliers of switchgear are Delle (France) and Sprecher and Schuh (Switzerland). The German manufacturers, Siemens, AEG, and Calor-Emag, also compete. Their equipment has a reputation for good performance; in addition, some end users have standardized on German switchgear and prefer to continue because they have trained personnel to handle and service the equipment and maintain stocks of spare parts.

Table 2.—Netherlands: Major suppliers of electrical power equipment

Domestic manufacturers

Stork N.V.
Boilers

Rhine-Schelde-Verolme
Boilers

Holec (amalgamated group of five major electrical equipment manufacturers)
Hazemeyer
Switchgear, distribution panels

Coq B.V.
Switchgear

Smit Transformatoren (Nijmegen)
Transformers

Heemaf B.V.
Rotating machines, alternators, nobreak sets (8-300 kVA)

Smit Slikkerveer B.V.
AC and DC generators, setbuilders, alternators (up to 440 MVA)

De Industrie
Diesel engines (300-750 rpm)

DAF (van Doorne)
Diesel engines (2,200-2,500 rpm)

Dynaf
Alternators, setbuilders (3,000 rpm and 1-1,500 kVA)

Stork-Werkspoor
Diesel engines, setbuilders (400-1,800 rpm and 100-8,000 kVA)

Thomassen
Gas and diesel engines

N.V. Nedalo
Setbuilders (30-100 kVA)

Samofa
Diesel engines, setbuilders (2-22.5 kVA)

IEO Breda
Distribution transformers (up to 1,650 kV)

Philips
Fractional hp motors

NKF (subsidiary of Philips)
Cables

Third-country manufacturers

KWU (Germany)
Turboalternators and generators

Alsthom (France)
Turboalternators and generators

BBC (Switzerland)
Turboalternators, transformers, switchgear

ACEC (Belgium)
Turboalternators, transformers

Sprecher & Schuh (Switzerland)
Switchgear

ASEA-Lepper (Germany)
Transformers

Trafo-Union (Germany)
Transformers

Pauwels (Belgium)
Transformers

Elin (Austria)
Transformers

Delle (France)
Switchgear

Siemens (Germany)
Switchgear

AEG (Germany)
Switchgear

Calor-Emag (Germany)
Switchgear

Source: Bureau of International Commerce, Office of International Marketing research study.

The customs duties applicable to imports of electrical power equipment from the United States and other non-EEC countries range from about 10% to 20% ad valorem. Goods from EEC countries enter Holland free of duty. In general, electrical equipment that is acceptable for sale in Germany is also acceptable for sale in the Netherlands, subject to approval or possibly trial by KEMA. A number of the standards promulgated by KEMA are designed to protect domestic products against imports. Information on the availability of published standards in the Netherlands may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.[1]

Domestic production.—The manufacture of electric power equipment in the Netherlands is highly concentrated, and production is largely in the hands of four large, efficient, specialized firms: The Holic group, Stork, RSV and NFK, which are described below.

The manufacture of electrical power equipment is dominated by the giant Holec (Holland Electrical) group. Holec was formed in 1969 through the merger of Smit-Nijmegen and Heemaf, two large

[1] The power supply throughout the Netherlands is 380 V, 3-phase, 50 hertz, with attendant 220-V, single-phase supply. Wiring is usually double insulated, not grounded. The metric system is the statutory standard for weights and measures.

Table 3.—Netherlands: Estimated imports of electrical power equipment, 1973, 1974, and 1979
(in millions of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	.54	.60	.8
Germany	4.64	5.00	7.0
United Kingdom	3.83	3.50	3.0
France	1.81	2.00	3.0
All others	1.94	2.00	3.0
Subtotal	12.76	13.10	16.8
Transmission and distribution equipment			
United States	.16	.16	.2
Germany	7.90	8.00	10.0
France	3.74	4.00	5.7
Switzerland	2.56	2.74	2.5
United Kingdom	2.10	2.10	2.0
All others	2.28	2.50	3.6
Subtotal	18.74	19.50	24.0
Totals			
United States	.70	.76	1.0
Germany	12.54	13.00	17.0
France	5.55	6.00	8.7
United Kingdom	5.93	5.60	5.0
Switzerland	2.56	2.74	2.5
All others	4.22	4.50	6.6
Grand total	31.50	32.60	40.8

[1] For exchange rates, see table 1.
Source: Netherlands Trade Statistics 1973 and Bureau of International Commerce, Office of International Marketing research study.

companies that earlier in the decade had consolidated most of the country's important heavy electrical equipment manufacturers. After realinement, Holec comprised five major companies, namely: Hazemeyer B.V., Coq B.V., Smit Transformatoren (Nijmegen), Heemaf B.V., and Smit Slikerveer B.V.

Included in the Holec group are a number of foreign subsidiaries, including S.A. Coq France and Hazemeyer S.A. (France), Hazemeyer SAE Switchgear Pty. Ltd. (Australia), Heemaf SKA Motorenwerk AG (Germany), and J. Kamps & Co. S.A. (Belgium), as well as some domestic manufacturers of products other than electrical power equipment. Total domestic sales in 1974 amounted to $158 million and employment exceeded 7,900. Exports accounted for more than one-fifth of the sales total.

Smit Nijmegen is the only domestic manufacturer of transformers above 2 MVA and in 1974 supplied about 55% of this $30-million market. Another Dutch manufacturer, IEO Breda, competes with Smit Nijmegen for sales of distribution transformers up to 1,650 kVA. Together the two firms accounted for nearly 70% (50% Smit and 18% IEO Breda) of 1974 sales.

For switchgear above 1 kV, Hazemeyer and Coq suppiled about two-thirds of the 1974 market. The market for gear below 1 kV is highly fractionated; most local production is based on imported German components.

Hazemeyer also has a large share of the market for distribution components and builds about one-half of the sophisticated panels sold in the Netherlands; many small domestic builders base their producion on German, French, and Danish components. All motor control components are imported, as are some fuses.

Stork N.V. and Rhine-Schelde-Verolme (RSV), which produce power boilers and steam raising plants, make the country entirely self-sufficient in this equipment category. The two split the market and had combined sales of $120 million in 1974. Each produces only mechanical equipment and has links with foreign turbine suppliers. Stork, which previously built turbines, sold that portion of its business to KWU, and the two firms agreed to collaborate. However, Stork has received little business from KWU in recent years, so the association may be dissolved. RSV has an arrangement with Chicago Bridge & Iron Co. and GE under which the two U.S. firms provide RSV's wholly owned subsidiary, Rotterdam Nuclear B.V., with technical assistance for the production of pressure vessels and other components for nuclear reactors. An earlier plan for GE equity participation failed.

The remaining large domestic manufacturer is Kabel BV a cable-producing subsidiary of Philips. NKF, operating in conjunction with Felten and Guilleaume (a German subsidiary of Philips) is the foremost cable producer in Europe. Philips is also a large buyer of heavy electrical components.

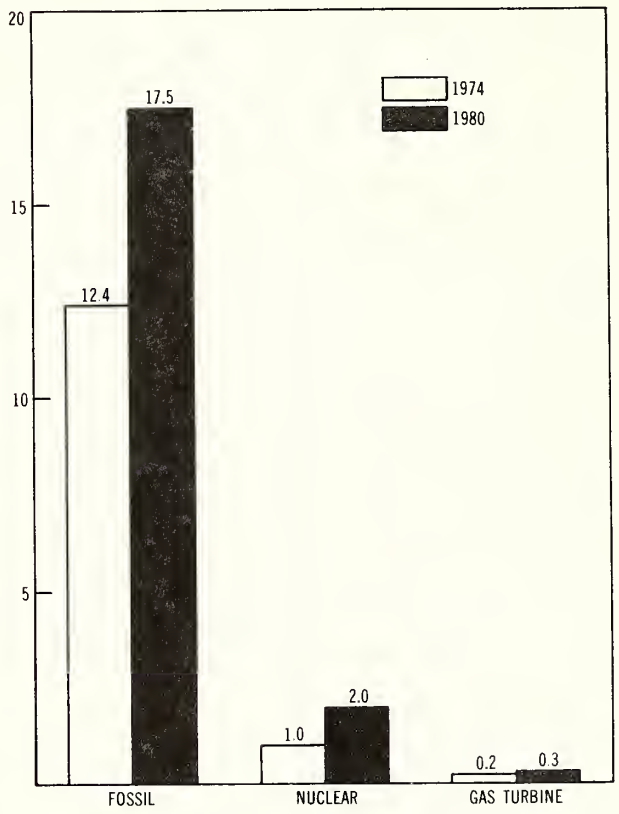
End Users

Electric utilities.—Furnishing virtually the entire power supply of the country, Dutch utilities in 1974 had a generating capacity of 13,600 MW, which they planned to boost to 19,800 MW by 1980, and to 26,800 MW by 1985. They also plan to diversify their fuels, reducing dependence on gas, while increasing usage of oil and nuclear plants (see figure 2).

Because an acceptable long range energy policy has not yet been approved, expansion of capacity will probably be slower than anticipated, while shifts in fuel will be more rapid, except for the use of nuclear power. The Netherlands, which commissioned its first nuclear power station on an experimental basis in 1973 and subsequently planned three additional 1,000-MW stations, has not yet been able to select sites or begin scheduling the projects. For environmental reasons, none of the municipalities suitable as a potential site will consent to host a facility. In terms of nuclear power equipment expen-

Figure 2.—Netherlands: Electric utility generating capacity, 1974 and projected 1980

(in gigawatts)



Source: Elektriciteit in Nederland, 1974, and Bureau of International Commerce, Office of International Marketing research study.

ditures, however, spending is forecast to increase from about $15 million in 1975 to $50 million in 1980, by which time some definite progress is anticipated.

Large expenditures will continue to be focused on power boilers and steam generating equipment. The former are projected to rise from $145 million in 1975 to $240 million in 1979, while the latter is expected to increase from $130 million to $200 million (see table 4). Trade sources anticipate that a high proportion of the new expenditure will be undertaken in joint venture with Germany and Belgium. The Netherlands has sold power directly to Germany through the national surplus 380-kV grid, and gas to the utilities of both nations via pipeline. In 1975, however, the State Gas Organization terminated all export contracts.

Utility purchases of transmission and distribution equipment, which rose from $130 million in 1972 to $260 million in 1975, should reach $400 million in 1979 if the forecast load growth is attained.

Overall, the utilities' expenditures on electric power equipment are expected to reach $900 million in 1979, or nearly 92% of total domestic purchases. In comparison, utility purchases amounted to $294 million in 1972, representing only about 84% of the market.

Table 4.—Netherlands: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	77	89	120	145	240
Nuclear reactors	10	10	10	15	50
Turbine generator sets					
Steam	75	85	113	130	200
Gas	2	5	10	10	10
Total	164	189	253	300	500
Transmission and distribution equipment					
Distribution transformers	18	24	30	56	58
Small power transformers	8	9	10	11	15
Secondary unit substation transformers	15	18	24	30	50
Large power transformers	20	25	32	39	69
Switchgear	65	80	100	120	200
Power circuit breakers	3	3	3	3	6
Control circuit relays	1	1	1	1	2
Total	130	160	200	260	400
Grand total	294	349	453	560	900

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Dutch statistics and trade source estimates.

In the Netherlands, 12 large municipally controlled provincial companies generate power which they distribute to some 80 organizations controlled by smaller municipalities. Distribution, via the 380-kV nationwide grid, and generation and transmission are effectively coordinated by a voluntary national industry group, the Association of Managing Directors of Electricity Supply Undertakings in the Netherlands (Vereniging van Directeuren van Elektriciteitsbedrijven in Nederland—VDEN). VDEN has sponsored the establishment of several important organizations: the standards and testing organization, KEMA; the Joint Nuclear Energy Power Station of the Netherlands, (Gemeenschappelijke Kernenergiecentrale Nederland); and the Cooperative Electricity Generating Companies (N.V. Samenwerkende Elektriciteits-Produktiebedrijven — S.E.P.), which operates the national grid.

Current plans call for Dutch power stations to add 13 gas-fueled generators by 1979 with an aggregate capacity of 5,400 MW. Most of these scheduled projects will probably be changed to oil or coal. Plans for gas turbines and combined sets provide for almost 250 MW of extra generating capacity (see table 5).

Industry and Government.—For the most part,

Table 5.—Netherlands: Current and planned construction/expansion of electric power plants, 1975-80 [1]

Type	Number of units added	Total generating capacity added (MW)
Natural gas [2]	13	5,420
Gas turbine	3	76
Combined gas turbine	2	168

[1] A detailed breakdown of individual construction projects, giving such information as names of contracting engineers, starting and expected competition dates, costs, etc., can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] All natural gas plants will probably be changed to oil or coal.

Source: Bureau of International Commerce, Office of International Marketing research study.

large industries purchase power directly from the supply companies, although some standby equipment is required for telephone, computer, hospital, and similar use. Diesel set manufacturers have a substantial market in the large Dutch shipbuilding industry and among the large Dutch firms, including Unilever and Shell, whose foreign establishments and subsidiaries frequently require diesel generators. Moreover, the Netherlands has strong trade ties with Indonesia and the West Indies, where diesel sets are in demand by plantations, mines, and villages.

Original equipment manufacturers (OEM's) constitute a large market for components and subassemblies. Aggregate purchases amounted to $61 million in 1975 and are projected to exceed $108 million in 1979. Most OEM's are large, highly efficient organizations which purchase subassemblies from a variety of sources, both domestic and foreign, generally through a few large, domestic wholesalers.

Typical of imported components and subassemblies (and frequently furnished by German firms) are: D-Type fuses up to 62.5 A; NH-type fuses up to 1,000 A; cam switches; fault-making, load-breaking switches up to 2,000 amps at 380 V; and fringe-range contactors, relays, pushbuttons, and indicator lights. Also imported for production are flow, frequency, gas, integrating, load, moisture, pH, and temperature meters (both indicating and recording). Competitively priced U.S. components and subassemblies could probably be introduced into the market through wholesalers wishing to broaden their product range.

Except for a small amount of electrical power equipment for use in drainage operations, the Government of the Netherlands has little impact on the market. It uses less than 1% of the overall national load; standby power is not usually necessary. As a matter of policy, the Government will normally select Dutch-made products in preference to imports. The principal public sector entities engaged in the purchase of electrical power equipment are the Water Supply Authority, the Hospital Service, the Post, Telephone and Telegraph Service, and the Railways.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on the Netherlands is available on a continuing basis from:

Country Marketing Manager—Netherlands
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

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U.S. Department of Commerce
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The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Netherlands." DIB 76-02-505, August 1975.

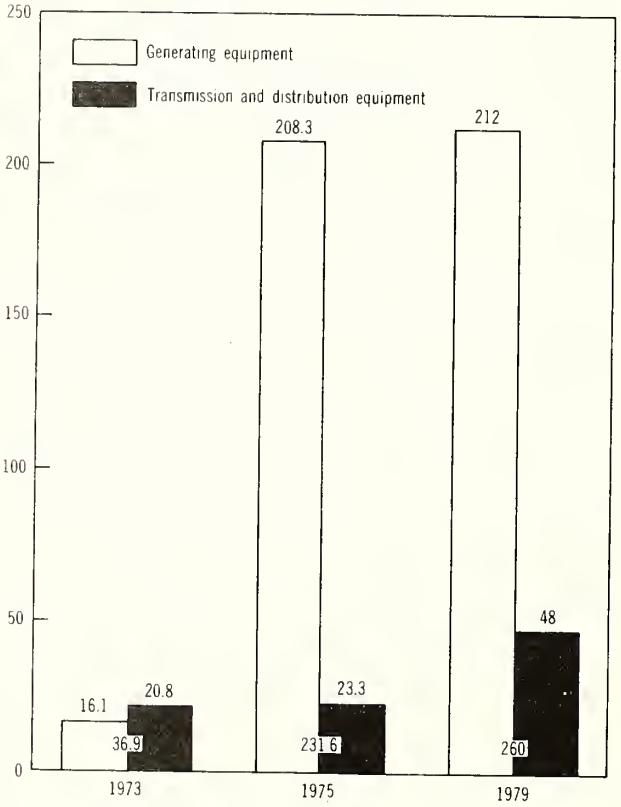
Electrical Energy Systems
Republic of China (Taiwan)

A steadily growing industrial economy makes the Republic of China an excellent market for manufacturers of electrical generation, transmission and distribution equipment. Sales of electrical energy systems grew from $89.4 million in 1972 to a 1975 total of $231.6 million and are projected to grow to $260 million in 1979 (see table 1 and figure 1).

As part of the Government's efforts to reduce the island's dependence on oil, the national utility, the Taiwan Power Company (TPC), is investing heavily in nuclear power plants. Construction of the first of three plants has already begun. Contracts for all of the reactors and generators have been won by American companies.

Figure 1.--Republic of China (Taiwan): Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



1. For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Republic of China statistics and trade source estimates.

Spurred by these nuclear equipment purchases, imports of U.S.-made power equipment increased from their 1973 level of $29 million to over $50 million in 1974, when U.S. sales represented a 58% share of the overall import market. Purchases of U.S.-made electrical power equipment are projected to exceed $85 million for 1979, about one-half of the overall import market and about 37% of the total market for that year.

Foreign engineers design the large part of Taiwan's electrical energy facilities. Nuclear installations in particular are contracted to American companies both for design and construction. Consultants are normally allowed to purchase machinery from their home country after approval from the Chinese client.

Competitive Environment

The Republic of China's energy equipment manufacturing industry is largely dependent on foreign technology and can supply only a limited portion of the market (see table 2). Imports account for the overwhelming percentage of Taiwan's total expenditures on electrical energy equipment; their market share in 1979 is projected at almost 70%. The United States and Japan are the major foreign suppliers to this market; in 1973 and 1974 they together accounted for approximately 85% of total power equipment imports (see table 3).

Imports.—Imports of electrical energy systems and equipment into Taiwan rose from $56 million in 1973 to $87 million in 1974, a jump of 55%. Generation equipment totals increased from $47.7 million to $61 million in those years, and transmission and

Table 1.—Taiwan: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars)[1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment ...	40.5	6.7	88.1	201.0	200
Transmission and distribution equipment ...	26.8	9.9	10.5	11.2	32
Total	67.3	16.6	98.6	212.2	232
Industrial companies					
Generation equipment ...	4.7	5.7	3.9	3.4	6
Transmission and distribution equipment ...	8.7	7.0	6.8	7.2	10
Total	13.4	12.7	10.7	10.6	16
Government (other than utilities)					
Generation equipment ...	4.2	3.7	3.6	3.9	6
Transmission and distribution equipment ...	4.5	3.9	3.8	4.9	6
Total	8.7	7.6	7.4	8.8	12
Grand total	89.4	36.9	116.7	231.6	260

[1] All figures converted at the following rates: 1972—US$1=NT$ 40; 1973 and thereafter—US$1=NT$ 38.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Republic of China statistics and trade source estimates.

distribution equipment values from $8.3 million to $26.2 million. Total imports of both generation, and transmission and distribution equipment are projected to more than double between 1974 and 1979.

American companies account for more than half of the import market; 52% and 58% shares in 1973 and 1974, respectively. The success of American manufacturers is based mainly on technical superiority, especially in generation equipment. TPC has expressed a preference for generation equipment made in the United States because of its durability, quality, and consistency with specifications. An additional factor has been the active role of American banks in financing imports of U.S.-origin equipment. Trade sources believe that this commanding U.S. competitive position will be maintained.

Sales of generating equipment by U.S. suppliers surged from $27.1 million in 1973 to a level of $45.5 million in 1974. Further plans for expanding generating capacity in Taiwan suggest that in 1979 the value of such equipment imported from U.S. manufacturers should show an increase of 65% from 1974 levels, reaching a figure of $75 million.

Sales of transmission and distribution equipment from U.S. companies rose from $2 million in 1973 to $4.9 million in 1974, representing respective shares of 24% and 18.6% of all such imports. U.S. sales are projected at $10.5 million in 1979.

Japanese firms are leaders in sales of transmission and distribution equipment to Taiwan; sales rose from $3.2 million in 1973 to $13.2 million in 1974, or 50% of all such imports in 1974. Purchases of this equipment from Japanese companies are projected to reach $19.6 million in 1979, representing a decline in market share of almost 10%.

The success of Japanese transmission and distribution equipment firms is based primarily on competitive pricing and excellent service, both of which are important to Chinese purchasers. Japanese-made equipment has a reputation for first-rate quality, and the companies for meeting any special technical requirements of their customers.

Imports of generation equipment made in Japan were $17 million in 1973 and $9 million in 1974 or 35% and 15%, respectively, of the generation equipment import market.

No other foreign manufacturers have made substantial inroads into the local market for generation equipment. Germany, Switzerland, and the United Kingdom have had only moderate success in selling transmission and distribution equipment. Collectively, they sold $800,000 of such equipment in 1973 and $5.7 million in 1974. Despite this growth in sales, these countries only accounted for an aggregate import market share of about 22% in 1974.

Trade and technical regulations.—Customs duties charged by the Republic of China on electrical power equipment range from 7 to 46%. Rates generally are higher on products that are produced by local companies such as LV transformers, low-pressure power boilers, and electrical capacitors. Major nontariff barriers affecting importation of electrical power systems are the Government's foreign exchange controls, prior deposit requirements on all imports, and harbor dues imposed on all imports. After clearance from customs, imported power equipment is treated the same as locally manufactured products.

All aspects of nuclear power, fuel, production, research, etc. are regulated by the Atomic Energy Council, an official body that is in turn supervised by the Executive Yuan (Branch). There are no technical standards or licensing requirements that might adversely affect imports.[1]

Trade practices.—Procurement procedures do not constitute a barrier to imports of electrical power equipment. TPC generally is required to make purchases by open, competitive tenders. However, generation equipment can be purchased through direct negotiation with a supplier. Periodic purchases of transmission and distribution equipment are made by the Procurement Department of the Central Trust of China, the Government's bank and purchasing agent, through open tender.

Spare parts are bought either directly from local manufacturers or indirectly from local agents for foreign suppliers. Since there are few sales subsidiaries or branches of foreign suppliers, local agents play a

[1] The electrical power supply characteristics in most areas of Taiwan are 110/220 volts, single- or 3-phase. Transmission voltages are 33 kV. 66kV. and 161 kV. Frequency is uniformly 60 hertz. The metric system is the standard system of weights and measures.

Table 2.—Taiwan: Major suppliers of electrical power equipment

Domestic manufacturers

Allis Electric Co.
Transformers, switchgear

Shihlin (licensee of Mitsubishi, Japan)
Power transformers

Tatung (licensee of Westinghouse, U.S.)
Small generators, transformers, distributors

Changhsin (licensee of, Japan)
Transformers

Shin Tai Li (licensee of Aichi Electric, Japan)
Transformers

United States manufactures

General Electric
Gas turbines, generators, reactors, relays, switches

Westinghouse
Generators, reactors, relays, switches, condensers, transformers

Bryon Jackson Co.
Pumps

Ingersoll Rand Co.
Pumps

Curtiss-Wright Power Systems International Ltd.
Power generation systems, gas turbines

Garrett Corp.
Gas turbine generator sets

Dynamics Corp. of America, Fermont Division
Generator sets

Yarway Corp.
Valves, metering pumps

McGraw-Edison
Transformers

Third Country manufacturers

Mitsubishi Co. (Japan)
Turbine generators, power piping, exchangers, switchgear

Mitsui Co. (Japan)
Transformers

Hitachi Co. (Japan)
Containment vessel, transformers, switches, breakers

Sumitomo Co. (Japan)
Transmission and distribution equipment

Takada Co. (Japan)
Transmission and distribution equipment

A.E.G. (Germany)
Generators

Siemens (Germany)
Transmission and distribution equipment

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official Republic of China statistics and trade source estimates.

very important role in marketing electrical power equipment in Taiwan.

Engineering firms are usually consulted when major power equipment purchase decisions are to be made. TPC, for example, employs consulting and contracting engineers for almost all major projects. Foreign engineers exert direct influence on purchases because they are generally authorized to procure equipment—mainly generators and auxiliary parts—by open bidding in their home country. The final sale, though, is subject to formal approval by TPC.

American consulting firms have been important in the development of Taiwan's electrical power sector, especially in the fields of thermo and nuclear power. TPC is expected to continue to rely on U.S. consultants because they believe them to be technologically advanced in the nuclear power field, and because the preponderance of TPC's creditors are U.S. suppliers who designate American consulting firms to participate in project development.

Domestic production.—The electrical power equipment industry in Taiwan is young and relatively underdeveloped but growing. Virtually all production is confined to small, unsophisticated equipment. The annual production indexes of local power equipment industries increased from 100 in the base year of 1971 to 207, 410, and 421 in the 3 succeeding years. More specific detail on the growth of the domestic industry can be seen in table 4.

The number and type of local manufacturers, as approved by the Government's Bureau of Industrial Development, are:

- Power and distribution transformers 16
- Switchgear 15
- Power boilers 5
- Motor generators 2

Given the Government's continuing emphasis on the development of heavy industry in Taiwan, the domestic power equipment industry can be expected to show growth. However, it is not now included in the overall economic development plan and limitations in terms of financial resources and technical capabilities will likely restrict growth to existing product lines (small, unsophisticated products, such as transformers of 69 kV and below, motor-driven generators, and power boilers), at relatively low prices. Exports of electrical power equipment have been negligible.

End Users

Electric utilities.—To meet the rising demand for electrical power from the country's expanding indus-

Table 3.—Taiwan: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in thousands of U.S. dollars)[1]

	1973	1974	1979
Generation equipment			
United States	27,095	45,540	75,000
Japan	16,878	9,105	19,000
Germany	245	1,847	4,500
Switzerland	57	364	—
All others	3,473	3,955	26,500
Subtotal	47,748	60,811	125,000
Transmission and distribution equipment			
United States	1,989	4,891	10,500
Japan	3,150	13,223	19,600
Germany	228	3,391	7,000
Switzerland	578	1,635	—
All others	2,372	3,084	13,300
Subtotal	8,317	26,224	50,400
Totals			
United States	29,084	50,431	85,500
Japan	20,028	22,328	38,600
Germany	473	5,238	11,500
Switzerland	635	1,999	—
All others	5,845	7,039	39,800
Grand Total	56,065 [2]	87,035	175,400

[1] For exchange rates, see table 1.

[2] This figure exceeds the total estimated sales figure of 1973 contained in table 1 because of bookkeeping practices of the Taiwan Power Company, which delayed certain expenditure figures until early 1974.

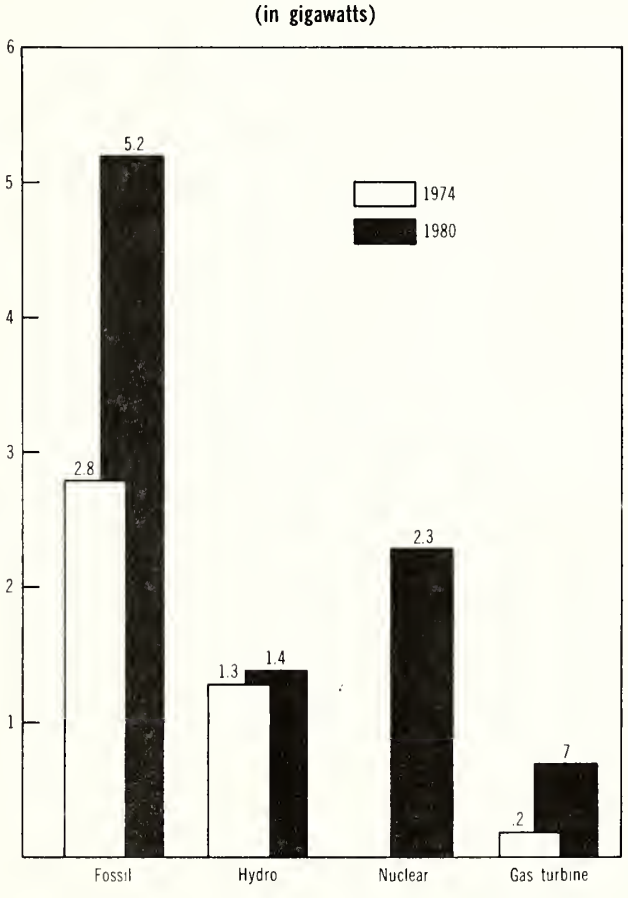
Source: Bureau of International Commerce, Office of International Marketing research study.

trial sector, TPC increased its generating capacity by more than 30% between 1973 and 1975 to 5,400 MW. Generating capacity in 1980 is projected at 9,600 MW, with nuclear steam and fossil fuel each accounting for about one-half of the increase. Two-thirds of the nation's electrical power in 1975 was produced from fossil steam, primarily oil (see figure 2).

TPC's capital expenditures exceeded $224 million in 1974, compared with expenditures of only $161 million in the preceding year (see table 5). Virtually all this increase was attributable to spending for hydro and nuclear generation, and a doubling of investment in transmission facilities to $34.5 million.

The major types of equipment expected to be most in demand by the electric utility sector are power boilers and nuclear reactors. Sales of power boilers to TPC were only $17.3 million in 1974, but this figure almost tripled to an estimated $51.4 million in 1975. The movement toward nuclear power caused a jump in expenditures from a nominal $400,000 for nuclear reactors in 1974 to more than $70 million in 1975 (see table 6); all of these were supplied by two American companies, General Electric and Westinghouse.

Figure 2.—Republic of China (Taiwan): Electric utility generating capacity, 1974 and projected 1980



Source: Taiwan Power Company.

Table 4.—Taiwan: Sales of power equipment by domestic companies, 1972-74

(Values given in thousands of U.S. dollars)[1]

	1972		1973		1974	
	Units	Value	Units	Value	Units	Value
Boilers	1,805	5,604	2,098	10,492	1,325	9,012
HV Transformers	47,727	13,360	30,945	18,099	25,064	17,623
Motor generators	56,375	1,488	125,991	3,422	141,317	3,941
Switches	10,607	3,221	27,308	4,855	16,742	5,018
Total	116,514	23,673	186,342	36,868	184,448	35,594

[1] For exchange rates, see table 1.

Source: Taiwan Industrial Production Statistics Monthly.

Table 5.—Taiwan: Estimated capital expenditures by electric utilities, 1973, 1974, and 1980

(in thousands of U.S. dollars) [1]

	1973	1974	1980
Generation			
Fossil	37,365	5,207	6,000
Nuclear	32,031	28,462	84,000
Hydro	24,808	100,760	45,000
Gas turbine	2,238	862	1,000
Internal combustion	150	58	50
Total	96,592	135,349	136,050
Transmission	17,027	34,524	50,000
Distribution	43,622	44,211	62,000
Miscellaneous	3,277	10,222	15,000
Grand Total	160,518	224,306	263,050

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study.

Table 7.—Taiwan: Current and planned construction/expansion of electrical power plants, 1975-85 [1]

Type	Number of units added	Total generating capacity added (MW)	Total cost (in millions of US$)[2]
Hydroelectric	3	258	NA
Fossil steam	5	1,512	236.9
Nuclear	6	5,142	1,066.7
Gas turbine	8	518	84.6
Pumped storage	1	200	NA

[1] A detailed breakdown of individual construction projects giving such information as name of contracting engineer, starting and expected completion dates, costs, etc. can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] For exchange rate, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Value based on official Republic of China statistics and trade source estimates.

Total transmission and distribution equipment sales to the utility sector were virtually unchanged in the 1974-75 period; the only sizable growth was in sales of large power transformers.

TPC (also called "Taipower") is the only electrical utility in the country and is under direct control of the Ministry of Economic Affairs' Management Committee for National Businesses. The bulk of TPC's purchases in recent years has been associated with its expansion of hydroelectric generating capacity. However, in the face of soaring oil prices, TPC has begun intense concentration on developing nuclear power. Over the next few years, over $2 billion capital will be spent to develop nuclear power generating capacity.

When all three planned nuclear plants are completed by the mid-1980's, at a total cost of $2 billion, they should account for 36% of TPC's total generating capacity.

While the nuclear plants are under construction, fossil steam power capacity will be further expanded, but its share of total TPC generating capacity will decline from 64% in 1974 to 50% in 1985. After the nuclear power plants become operational about

Table 6.—Taiwan: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in thousands of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	12,135	5,427	17,286	51,390	75,400
Nuclear reactors	—	1,058	401	70,298	83,700
Turbine generator sets					
Steam	8,024	—	15,190	1,820	500
Gas	285	93	—	—	—
Hydraulic	227	102	21	4,240	5,300
Motor generator sets					
Diesel	13,510	—	41,884	52,719	20,000
Gasoline	—	—	—	—	—
Other	6,273	—	13,277	20,524	15,000
Subtotal	40,454	6,680	88,059	200,991	199,900
Transmission and distribution equipment					
Distribution transformers	5,415	2,536	6,222	1,584	8,700
Small power transformers	1,334	624	1,278	1,318	1,550
Secondary unit substation transformers	2,232	2,418	2,325	—	4,600
Large power transformers	9,732	3,258	—	7,032	8,900
Power regulators and boosters	894	356	147	592	1,500
Switchgear	1,766	243	10	7	1,600
Power circuit breakers	4,570	115	169	41	3,300
Control circuit relays	827	400	351	588	1,400
Subtotal	26,770	9,950	10,502	11,162	31,500
Grand Total	67,224	16,630	98,561	212,153	231,400

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Value based on official Republic of China statistics and trade source estimates.

1985, TPC foresees capacity increases limited to two sources: hydro and pumped storage (see table 7).

Twice every 5 years, TPC procures electrical power equipment. Views expressed by TPC and other users suggest that the following products have good sales potential for foreign manufacturers:

Boilers:
29–178 kg/cm² steam pressure
Prime movers:
14–375 MW capacity
Generators:
Under 375 MW
Power transformers:
345/161/33 kV, 167 MVA
154/69/11 kV, 200 MVA and 60 MVA
161/11.95–23.8 kV, 60 MVA
Power circuit breakers:
345 kV, 3,000 A, 25,000 MVA
161 kV, 2,000 A and 1,600 A, 10,000 MVA
161 kV, 1,600 A, 7,500 MVA
69 kV, 1,200 A, 3,500 MVA and 2,500 MVA
69 kV, 1,200 A, 2,500 MVA (for capacitor switching)
69 kV, 2,000 A, 3,500 MVA
14.4 kV, 600 A, 250 MVA
14.4 kV, 600 A, 250 MVA (for capacitors)
Air break disconnecting swtiches:
345 kV, 3,000 A (motor operating)
161 kV, 3,000 A (motor operating)
161 kV, 2,000 A (motor or manual operating)
161 kV, 1,600 A (motor or manual operating)
69 kV, 2,000 A (manual operating)
69 kV, 1,200 A (manual or motor operating)
Mobile generators and transformers for emergency use

Industrial end users.—The industrial sector has made about 10 to 15% of total electrical power equipment purchases in Taiwan in recent years. In 1973 and 1974, sector purchaser averaged $11.6 million, over two-thirds of which went for transmission and distribution equipment accounting for 32% of total sales of such equipment in 1974. Total sales to the sector were about $10.6 million in 1975.

In general, equipment purchased by the industrial sector is for emergency use only, since TPC provides electricity for virtually every industrial firms in the country. Principal owners of auxiliary generation equipment can be classified into the following categories, with the number of generators owned shown in parentheses: industrial plants (175), telecommunications (152), theaters (61), high-rise apartments (60), transportation (30), and radio and TV stations (23). The total number of generators owned in the sector is 651.

As TPC increases its generating capacity, industry's expenditures for electrical power equipment will cease to follow the overall increase in industrial production. The annual growth of such expenditures is projected to be in the 5 to 6% range in the near future, as compared with a rate of 7 to 10% in recent years.

Government (other than utilities).—Government expenditures accounted for over 6% of the electrical power equipment market in 1974 and over 3% in 1975. Purchases were valued at $7.4 million in 1974, about the same as the amount spent in the preceding year. In all cases, expenditures were fairly evenly divided between equipment for generation and for transmission and distribution.

Most government purchases in this area are for the use of military units, public utilities (such as water), telecommunications, petroleum refining, and railroads. They are expected to increase at a steady rate.

Additional Information

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BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

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The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Taiwan." DIB 76-01-500, August 1975.

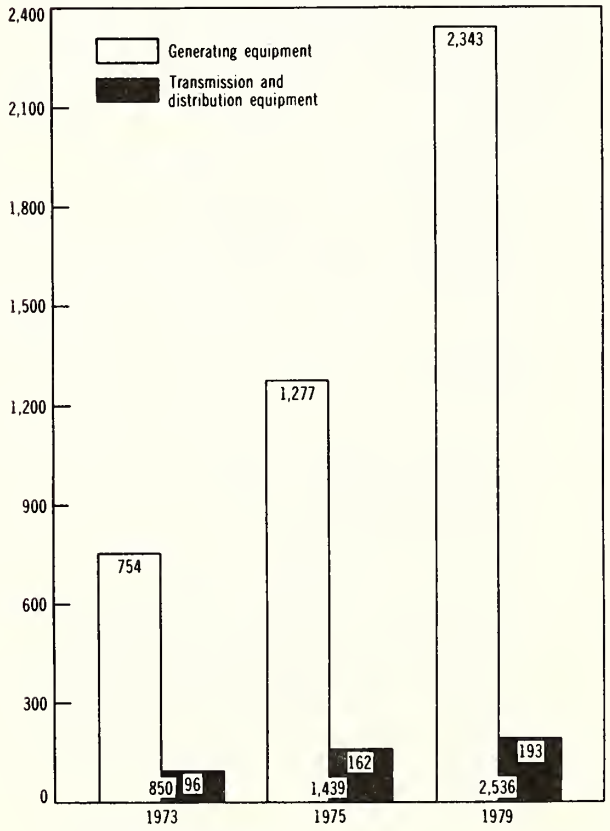
Electrical Energy Systems

Spain

Spain has experienced one of the fastest load growth rates in Europe, increasing about 10% every year. This growth has made Spain a prime market for electrical generation, transmission and distribution equipment. Sales of electrical power equipment grew from $803 million in 1972 to over $1.4 billion in 1975, about 95% of which was made to the national utility (see table 1 and figure 1). The load growth rate fell sharply following the energy crisis of 1973 and the ensuing rise in the price of electricity. Governmnt projections of electrical energy equipment purchases exceeding $2.5 billion in 1979 were drawn up prior to these recent developments and may be revised.

Figure 1. Spain: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For exchange rates, see table 1.

Source: National Electrical Plan 1976-1985, published December 1973.

Rephasing of the national plan will probably depend upon the load growth in 1975 and 1976 and so cannot yet be predicted with accuracy. Trade sources speculate that electrical energy equipment investments will probably occur as scheduled through 1976, but that those planned for the remainder of the 1970's could be halved and those for 1980-85 cut by as much as two-thirds. Alternatively, since many orders for large purchases have already been placed for delivery up to 1980, a major cutback may be delayed until 1980-85.

Since power stations are not built on a turnkey basis in Spain, consulting and contracting engineers have considerable influence on purchasing decisions with regard to electrical energy equipment there. American consultants have played a particularly important role in nuclear plant construction. American consultants involved in designing chemical plants and oil refineries have also been able to select the electrical power distribution equipment to be used in such installations: for example, low voltage distribution boards, power factor correction equipment, and customized equipment for special sites. These consultants are usually required to hire Spanish nationals on such projects to give them experience in the subject field.

Competitive Environment

Imports.—Imports represented less than 1% of all electrical energy equipment bought in Spain in the mid-1970's. The value of imported equipment rose from about $3.7 million in 1973 to $4.2 million in 1974 and is projected to reach $5.4 mil-

Table 1.—Spain: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	685	715	956	1,232	2,293
Transmission and distribution equipment	63	75	93	136	163
Total	748	790	1,049	1,368	2,456
Industrial companies					
Generation equipment	30	32	34	36	38
Transmission and distribution equipment	16	18	20	22	24
Total	46	50	54	58	62
Government (other than utilities)					
Generation equipment	6	7	8	9	12
Transmission and distribution equipment	3	3	3	4	6
Total	9	10	11	13	18
Grand Total	803	850	1,114	1,439	2,536

[1] All figures converted at the following rates: 1972—US$1=Ptas 64.5; 1973—US$1=Ptas 58.8; 1974 and thereafter—US$1=Ptas 57.6.
Source: National Electrical Plan 1976-1985, published December 1973.

lion in 1979 (see table 2). Generation equipment accounted for well over two-thirds of all imports in 1973 and 1974, and it is forecast to represent an increasing share of the total import market throughout the remainder of the 1970's.

In 1973, U.S. import sales were valued at about $650,000 (18% of the import market). This figure reached $830,000 in 1974 (20%). Almost all of the electrical energy equipment imported into Spain from the United States is for power generation.

The import figures for generation equipment reflect the fact that in 1973 and 1974 General Electric (GE) and Westinghouse were awarded contracts for nuclear power development in Spain. The relatively large French share of the import market in 1973-74 is explained by the fact that the French subsidiary of GE owns 20% of the shares of the Spanish GE subsidiary; considerable nuclear power equipment imported in 1973-74 therefore originated in neighboring France rather than the United States. The recent increase in the German share of the import market stems from the award in 1975 of a contract for two nuclear stations to the German-based Kraft-Werke Union (KWU).

Both KWU and the two American-based companies managed to include 60% Spanish-made equipment, as requested by the Government, in their 1975 tenders. In the future, Spain is seeking 80% locally manufactured content in nuclear bids. Trade sources report that the Spanish subsidiaries of GE and Westinghouse believe that they are better able to meet the requirements for 80% Spanish-made equipment in future nuclear bids than the German-based firm with its subsidiaries.

Subsidiaries of German and French firms manufacturing transmission and distribution equipment in Spain have made considerable effort to import components, subassemblies, and ancillaries from their parent firms. Imports of French- and German-origin equipment consist primarily of motor control and distribution components for high and low voltage panels made in Spain.

Firms in the United Kingdom also supply a wide range of electrical energy equipment, including electrical equipment for a complete steelwork to cable accessories for a cable factory.

Prospects for sales of imported equipment in the Spanish market are severely limited by the cutback in growth. Since conventional terminal stations are rapidly being phased out in favor of nuclear stations, auxiliary equipment for power stations is also in little demand. The chief opportunity for sales of U.S.-origin equipment is in the lower end of current and voltage ratings, and the market is limited to the industrial sector and original equipment manufacturers. Expected to be in demand are panel components, special cables for electronic printed circuit board interconnections, and specialized equipment to be used with diesel alternator sets for shutdown routines in oil refineries and chemical plants. Molded case circuit breakers (MCCB's) are also predicted to be in demand. Trade sources advise small companies and new entries to the market to promote their low-volume, high-priced specialties in the increasingly sophisticated Spanish market.

Trade and technical regulations.—Customs duties on imports of electrical energy systems from the United States range from 1% for gas turbines and nuclear reactors to 34% for electrical power machinery under 500 kilograms. Most electrical energy equipment is subject to rates of 14 to 22%. These charges are slightly lower than the standard Spanish tariffs and slightly higher than the rates applied to imports from the European Economic Community. A value-added tax intended to compensate for taxes which would have been paid had the item been manufactured in Spain is applied to all imports. This tax usually amounts to 12% of electrical energy equipment; exceptions include 9% for gas turbines and 4% for nuclear reactors. Although the import tariffs are relatively high in Spain, trade sources point out that the prices of Spanish-made electrical products average 30% higher than those of goods produced elsewhere.

Separate import licenses are required for major pieces of equipment, but repeated orders for minor items can be placed under a single license. All transactions involving imports in Spain are handled by Spanish agents or domestic firms.

There are no official standards concerning imported electrical energy equipment, but Spanish en-

gineers are inclined toward use of International Electrotechnical Commission specifications.[1]

Domestic production.—The manufacture of generation, transmission, and distribution equipment began in Spain in the post-World War II years when firms with foreign licenses began assembling goods from imported components and subassemblies. Year by year the Spanish-made content of the products increased; as the quality improved, local manufacturers captured an increasing share of the market. Firms located in Spain now supply more than 99% of all electrical energy equipment bought in Spain. Spanish research and development facilities are, however, extremely limited, and so domestic manufacture usually lags behind advanced production elsewhere.

General Electrica Espanola S.A. (GEE) and Westinghouse S.A. are the leading manufacturers of electrical energy systems in Spain. GE (U.S.) controls 53% of the GEE shares, and Alsthom (CGE of France) holds 20%; most of the remaining shares are held by several members of Unidad Electrica S.A. (UNESA), including Hidroelectrica Espanola. The principal GEE factory at Galindo makes all the company's very high voltage and large products; the factory at Trapaga makes distribution equipment.

Westinghouse S.A. is 75% owned by the Power Systems Division of the Westinghouse Corporation (U.S.). The operations of Westinghouse S.A. are generally comparable to those of GEE except that Westinghouse does not make turbines; instead, another domestic company, Baszan, manufactures turbines for incorporation into Westinghouse-produced systems. Westinghouse has a factory near Bilbao to produce alternators and another at Cordoba to make transformers.

Both GEE and Westinghouse have been vulnerable to competition from smaller, specialized companies in Spain with lower overhead costs. For example, U.S.-designed small distribution transformers use more steel and copper than the latest European models, and thus cannot compete for their sale. As a result, Westinghouse S.A. has ceased manufacture of distribution transformers below 1 MVA and standard motors below 15 hp.

Another Westinghouse operation, Westinghouse Nuclear Espanola S.A. (a subsidiary of Westinghouse Nuclear Europe Inc. in Brussels), has a growing business in nuclear contracts in Spain.

[1] The standard power supply in Spain is 220 V, 50 hertz, single-phase, and 380 V, 50 hertz, 3-phase. Some power is still provided at 110 V, 60 hertz, but these supplies are being supplanted. The metric system of weights and measures is the statutory standard in Spain.

Information on the availability of published standards in Spain may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Table 2.—Spain: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in thousands of U.S. dollars) [1]

	1973	1974	1979
Generation equipment			
United States	634	800	1,200
France	1,009	1,000	1,000
Germany	422	600	1,000
United Kingdom	225	300	300
All others	287	300	500
Subtotal	2,577	3,000	4,000
Transmission and distribution equipment			
United States	23	30	40
France	224	250	300
Germany	379	400	500
United Kingdom	192	200	200
All others	300	320	360
Subtotal	1,118	1,200	1,400
Totals			
United States	657	830	1,240
France	1,233	1,250	1,300
Germany	801	1,000	1,500
United Kingdom	417	500	500
All others	587	620	860
Grand Total	3,695	4,200	5,400

[1] For exchange rates, see table 1.

Source: Spanish Trade Statistics 1973 and Bureau of International Commerce, Office of International Marketing research study.

Three local subsidiaries that have captured a part of the transformer, switchgear, and motor market formerly supplied by the two U.S.-based giants are Siemens S.A., AEG S.A., and ASEA S.A. ASEA, whose parent firm is Swedish, produces motor control panels and motors with capacities up to 40 hp. ASEA's annual turnover has averaged $100 million, but the firm now has problems of overcapacity and surplus manpower. Siemens and AEG, whose parent firms are German (both have 50% shares in KWU), have operated successfully in Spain since the 1950's and until recently manufactured a wide range of motors, transformers, and panel components. In 1975 they suffered serious reverses, and Siemens was reported to be greatly overstocked in electric motors. Meanwhile, AEG has stopped producing distribution transformers and is otherwise retrenching. Trade sources reported that the entire electric motor industry in Spain was operating at 40% capacity in 1975. Nevertheless, these firms have continued to work on contracts involving turbo-alternators. AEG and Siemens have now obtained their first nuclear orders through their connections with KWU.

Siemens and AEG are also major manufacturers of switchgear in Spain. As of 1974 they supplied 25% of the market for 1-kV to 30-kV equipment, valued at $120 million.

Two important joint ventures with foreign licenses

and capital which produce switchgear in Spain are Isodel-Sprecher (owned in equal parts by Sprecher and Schuh of Switzerland, Delle of France, and Spanish shareholders) and Metron S.A. (licensee of Hazemeyer of the Netherlands and SACE of Italy). Isodel-Sprecher is the leading supplier in Spain of switchgear with capacities above 100 kV. Another manufacturer of low voltage components in Spain is Calor-Emag, now a subsidiary of Brown-Boveri of Germany.

The Italian-owned firm CEAT, which is linked to General Cables (U.S.), supplies about 25% of the Spanish market for cables. Another Italian-owned firm, Pirelli, produces cables in Spain. Legrand (French-owned) and Bassani (Italian owned) are producers of electrical accessories (fuses, minor switchgear, and starter units) in Spain. Combustion Stein Astilleros S.A., a subsidiary of Combustion Engineering Inc. (U.S.), manufactures steam boilers in Spain. Cutler-Hammer Espanola S.A., a subsidiary of the U.K.-based Cutler-Hammer Europa, assembles panels from imported components. Amp Espanola S.A., a subsidiary of Amp Inc., makes electrical connectors in Spain.

The major wholly Spanish-owned firm in this electrical energy systems market is Agut S.A., which supplies 50% of the market for motor control components and panels in Spain. Crady also makes a variety of high quality switchgear and ancillaries, including some flameproof smaller products.

Four other locally owned companies which manufacture electric accessories, including motor control consoles and mini circuit breakers (MCB's), are Plastimetal, Niessen (with licenses through Busch-Jaeger to Brown-Boveri), BJC, and H. J. Simon (affiliate of Siemens). Embid has a Swiss license to make MCB's also. Spanish-owned firms making transformers below 40-MVA capacity include Elorriaga, OASA, Diestre, Incoesa, and Fecha. Elorriaga also makes standard motors up to 100 hp, and another domestically owned company, Comadron, makes standard motors up to 40 hp.

End Users

Electric utilities.—The 25 companies which make up UNESA are responsible for the generation, transmission, and distribution of about 90% of the electrical power in Spain. UNESA originated as a coordinating association for the companies. But as the network grew into a national grid, the electrical industry fell under the control of the Government through its Instituto Nacional de Industria (INI), the organization through which the State participates in companies in Spain. Increasingly the INI has provided the funds for the recent expansion of the industry, and consequently it now controls all policy and program decisions for the industry, including the National Plan promulgated in December 1973. Now that the expansion planned for the 1980's seems excessive, the electrical industry is working to regain its autonomy. To this end, UNESA is negotiating to buy back some of the shares sold by its members to INI to cover the cost of the rapid expansion.

The steady doubling of the load every 7 years over the 1949-74 period has permitted the construction of base load stations and the development of a 400-kV and 220-kV national grid in Spain. By 1973, as many hydroelectric projects as were feasible had been programed for development, and their share of the total generating capacity fell to just over 50%. At the same time, Spain was faced with a shortage of domestically produced coal and the necessity to import ever-increasing amounts of oil to fuel its fossil-powered plants. The 1973 National Plan, therefore, proposed a major program of nuclear stations to meet Spain's anticipated power needs. Although the stations would initially have only a 40% made-in-Spain element, this percentage was scheduled to double by the end of the decade. Thus a second objective of the plan was to develop a nuclear industry in Spain, which would eventually export nuclear products.

Figure 2 depicts the planned increases in power generating capacity in Spain through 1980. Total capacity is projected to rise from 23,470 MW in 1974 to more than 42,000 MW in 1980, with the share held by nuclear stations forecast to increase from 4 to 27% during the same period. The proportion of capacity represented by hydro power is projected to drop from 49% in 1974 to 37% in 1980, while fossil steam capacity will drop from 47 to 35% during the same timespan.

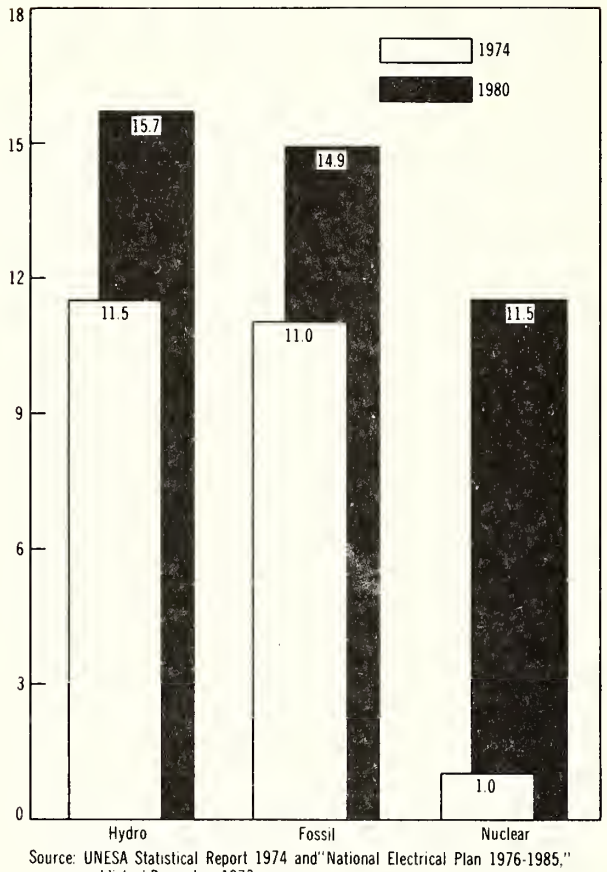
Table 3 outlines equipment expenditures by the electric utilities during the past 3 years and projects the 1979 expenditures on the basis of the National Plan. Most of the growth through 1979 can be attributed to the predicted rise in the value of purchases of nuclear reactors from $690 million in 1975 to more than $1.6 billion in 1979. Demand for hydraulic generator sets is also forecast to increase from $174 million to $330 million.

The planned construction or expansion of electrical power plants scheduled for 1975-82 is broken down by category in table 4. The 74 hydro, fossil, and nuclear units proposed for this period under the National Plan should increase the total electrical power generating capacity by more than 30,000 MW at an estimated cost exceeding $6.5 billion. The 20 nuclear plants account for about half of this investment and power yield.

Between 1969 and 1972, three nuclear power plants came into operation in Spain: one pressurized water reactor (PWR) type with 160-MW capacity built by Westinghouse, one boiling water reactor

Figure 2.—Spain: Electric utility generating capacity, 1974 and projected 1980

(in gigawatts)



Source: UNESA Statistical Report 1974 and "National Electrical Plan 1976-1985," published December 1973.

(BWR) type with 440-MW capacity built by GE, and one gas-graphite type with 484-MW capacity built by a French consortium. Westinghouse now has under construction six new 930-MW PWR plants scheduled for completion between 1976 and 1978. A 975-MW BWR plant now under construction by GE is scheduled to begin operation in 1978. Three other nuclear stations are scheduled for completion in 1980, but the contractors for them have yet to be agreed upon. Six more, including a PWR plant of 1,000-MW capacity to be built by KWU, are scheduled for completion in 1981. Sites have also been selected for 12 nuclear plants (11 with 1,000-MW capacity and 1 with 900-MW capacity) to be completed in 1982 and 1983.

Licensing and regulation procedures for nuclear stations are controlled by the Central Government. The National Plan incorporated a procedure for hearing objections to nuclear construction, and provincial delegations have reportedly caused some delays in construction.

Even though the load growth has dropped dramatically in the last 2 years, trade sources report that nuclear power station construction can still be justified in Spain. The amount of oil used for generation relates directly to the rainfall, which is generally concentrated between November and March. As the cold weather sets in and the domestic load rises, the hydro stations usually can accommodate it. Occasional extensions of dry weather into December, however, play havoc with the hydro power supply and necessitate the maintenance of small, inefficient reserve stations and peak-breaking gas turbines. Because of the ease with which solid fuel can be stocked until the next dry year, the Government may consider it feasible to eliminate use of oil above the average-year quantities. Hence, it may choose to cut back on hydro construction and proceed with the nuclear program.

Industrial end users.—Industry generates about 3,000 gigawatt hours (GWh) of a total 80,000 GWh of electricity in Spain. The installed generating capacity accounted for by industry has remained around the 830-MW level since 1960, although over the years some industrial end users have closed down their generators while others have installed new plants. There are two main reasons for this sector to provide some of its own power: first, the manufacturing processes of certain industries require steam, which can also be passed through turbines for electrical generation at no extra cost; and second, the public supply is subject to cuts as a result of strikes in the coal or supply industry. To cover

Table 3.—Spain: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	130	120	100	120	90
Nuclear reactors	150	200	455	690	1,650
Turbine generator sets					
Steam	280	250	220	233	208
Gas	15	15	15	15	15
Hydraulic	110	130	166	174	330
Total	658	715	956	1,232	2,293
Transmission and distribution equipment					
Distribution transformers	11	12	13	15	18
Small power transformers	6	7	8	10	14
Secondary unit substation transformers	8	9	14	18	22
Large power transformers	10	13	17	25	30
Switchgear	25	30	35	60	70
Power circuit breakers	3	4	5	7	8
Control circuit relays	—	—	1	1	1
Total	63	75	93	136	163
Grand Total	748	790	1,049	1,368	2,456

[1] For exchange rates and source, see table 1.

Source: National Electric Plan 1976-1985, published December 1973.

Table 4.—Spain: Current and planned construction/expansion of electrical power plants, 1975-82 [1]

Type	Number of units added	Total generating capacity added (MW)	Total cost (in millions U.S. $)
Fossil	14	5,350	1,155 [2]
Hydro and pumped storage	40	6,771	1,307
Nuclear	20	19,285	4,384

[1] A detailed breakdown of individual construction projects, giving such information as names of contracting engineers, starting and expected completion dates, costs, etc., can be found in the original research. For instructions on how to obtain this study, see "Additional Information" box.

[2] For exchange rate and source, see table 1.

expansion, however, industry usually turns to the public supply rather than to increased self-generated capacity.

Between 1972 and 1975, purchases of electrical power equipment by industry increased at an average annual rate of 8%; the value of equipment sales rose from $46 million to $58 million. Although generating equipment represented about two-thirds of the total bought between 1972 and 1975, distribution equipment sales increased at a faster pace in that period. Transformers and switchgear that take a high voltage supply from the national grid are the major items of distribution equipment purchased by industrial end users, and there is a marked tendency for industrial end users to seek the advice of the supply company on the equipment to be bought. Industry buys no transmission equipment. Industrial purchases of electrical energy equipment are expected to slow down somewhat during the latter half of the 1970's; they are projected to total $62 million in 1979.

U.S.-origin items expected to be in demand in this sector include 30-MW steam turbine sets, second-hand turboalternators, industrial gas turbine sets up to 10 MVA, alternators, in the 15-kVA to 100-kVA range, dry-type transformers (classes B, F, and H), flameproof switchgear, flameproof and explosion-proof motor starters, and cable junction boxes. Trade sources report that the Spanish fishing fleet needs generating sets in the 50-kVA range.

Original equipment manufacturers (OEM).—The OEM sector accounted for almost one-tenth of the entire market for electrical energy equipment throughout the first half of the 1970's, and it is projected to continue to hold the same share in the foreseeable future. Generation equipment represents about 90% of all OEM electrical energy equipment purchases. The value of OEM purchases of equipment rose from $80 million in 1972 to $134 million in 1975 and is forecast to reach $257 million in 1979.

Original equipment manufacturers are expected to continue to be the prime market for U.S. exports for the next few years. Spanish manufacturers have not found enough demand for specialized range items to justify their manufacture in Spain. Hence U.S. products expected to continue in demand throughout the 1970's include contactors, relays, pushbuttons, indicator lamps, limit switches, MCCB's, MCB's, air circuit breakers, fuse switches, ammeters, voltmeters, power factor meters, and programers. Of particular interest are flameproof types or special solid-state types to meet special requirements for extra reliability, silent operation, or miniaturization. Similarly, ultra-lightweight portable generators and ultra-quiet portable generators for nighttime use in urban areas are expected to be in demand.

Government (other than utilities).—Purchases of electrical energy equipment by this sector rose from $9 million in 1972 to $13 million in 1975 and were projected to reach $18 million in 1979. Generation equipment represents roughly two-thirds of the total government demand. Apart from purchases by the military, the nonutility government sector buys chiefly standby emergency sets for government buildings. The Government owns no transmission equipment, but it does have some distribution equipment (e.g., in hotels controlled by the Ministry of Tourism). "Buy-Spanish" policies prevail.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on Spain is available on a continuing basis from:

Country Marketing Manager—Spain
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 577-4650

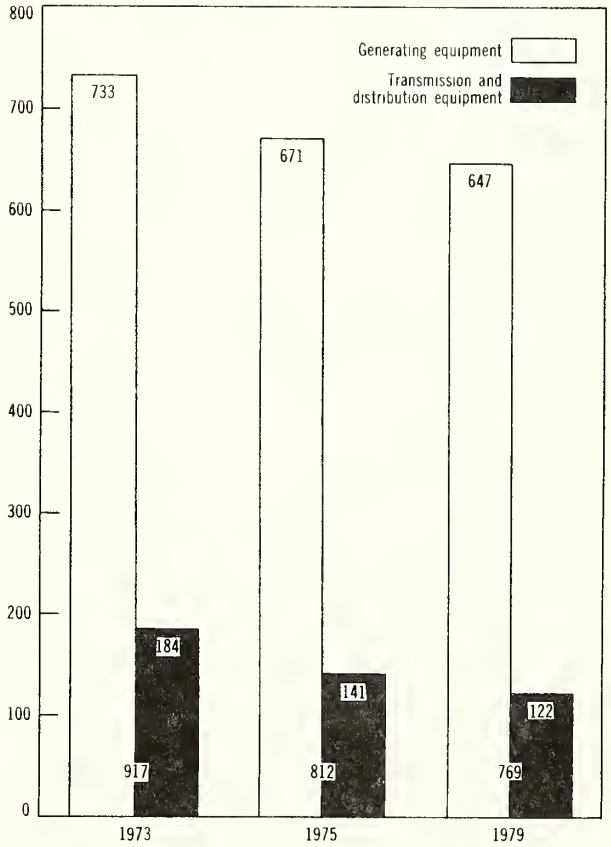
The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users; and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: Spain," DIB 76-03-505, October 1975.

Electrical Energy Systems
United Kingdom

The market for electrical generation, transmission and distribution equipment in the United Kingdom, which grew from $836 million in 1972 to $931 million in 1974, declined to $812 million in 1975 (see table 1). Equipment purchases are expected to decline slightly over the next several years to about $770 million in 1979 (see figure 1). Peak capital equipment expenditures by electric utilities in the late 1960's was attributable to a program of replacing small municipal stations with modern large baseload stations as well as an overestimate of future demand for power. Utilities are expected to continue to replace fossil-fueled stations with nuclear stations, to install peak-breaking gas turbine plants, and to undertake a program of modernization and repair work.

Figure 1.—United Kingdom: Total sales of electrical power equipment, 1973, 1975, and projected 1979

(in millions of U.S. dollars)[1]



[1]For source and exchange rates, see table 1.

Meanwhile, the industrial sector has become a major purchaser of electrical generating equipment and is expected to maintain its 1975 level of expenditures at about $300 million throughout the remainder of the 1970's. Miners and power station workers began a series of strikes in 1972 which culminated in a 3-day work week during the first quarter of 1974 for most of British industry. Frequent interruptions in public power supply has caused many industrial users to purchase standby generators. These users are exploring the use of such generators for peak-shaving opeartions.

The United Kingdom has been a pioneer in developing advanced types of nuclear reactors, high voltage transformers, switchgear, transmission lines, and large alternators and transformers. However, basic British research and development efforts are shifting toward developing equipment for the export market, which takes an increasing share of U.K. equipment production.

Competitive Environment

Domestic manufacturers still supply electrical energy equipment used in the United Kingdom but their deteriorating position is expected to bring increased imports of this equipment. Imports accounting for 12% of the total market in 1974 could reach 16% by 1979.

Imports.—Imports totaled over $111 million in 1974 and are predicted to exceed $122 million in 1979 (see table 2). Transmission and distribution

Table 1.—United Kingdom: Estimated sales of electrical power equipment to major end-user sectors, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Electric utilities					
Generation equipment	467	453	414	391	367
Transmission and distribution equipment	163	156	132	113	94
Total	630	609	546	504	461
Industrial companies					
Generation equipment	187	280	350	280	280
Transmission and distribution equipment	19	28	35	28	28
Total	206	308	385	308	308
Grand Total	836	917	931	812	769

[1] All figures converted at the following rates: 1972—US$1 = .400 pounds; 1973—US$1 = .408 pounds; 1974 and thereafter—US$1 = .428 pounds.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official U.K. statistics and trade source estimates.

equipment represented about 80% of all imported equipment in recent years, and is expected to increase its share marginally over the next few years.

Manufacturers in the United States accounted for 24% of imports in 1973 and 1974. More than three-quarters of the U.K. purchases from U.S. firms are for transmission and distribution equipment, particularly motor controls and distribution items. The market for U.S.-origin generating equipment has been almost entirely in the industrial sector. Generators for offshore oil rigs are in particular demand by U.S. oil companies; of prime interest are packaged gas turbine sets. Trade sources report that new, advanced products not yet made in the United Kingdom have the greatest sales potential.

The expansion of the market for American-origin products in the United Kingdom is limited primarily by the rise of Central European producers, the unification of the European Common Market and electrical product standards.

German firms supply engines and alternators to British end users. Manufacturers in the Netherlands provide alternators and generator sets. Brown-Boveri International sells generating equipment from its German and French factories to the U.K. market. Manufacturers in France provide the United Kingdom with large diesel engines, many of which are reexported, and Japanese companies sell small generating sets. Firms in France, Germany, Switzerland, and Sweden supply distribution components. Tap changers come from Germany and Sweden, Brown-Boveri provides turbine speed control equipment, and French firms supply molded–case circuit breakers and CEE17 plugs and sockets.

American oil companies engaged in North Sea exploration and construction have a marked preference for U.S. equipment. As a result, U.S. consulting and contracting engineers have gained an entree in the British oil and petrochemical industries.

Technical and trade regulations.—Customs duties on imports of electrical energy equipment from the United States range between approximately 5% and 12%. It is possible to obtain free entry for products proven to be unavailable in the United Kingdom, but a separate application is required in each case. There are no import quotas, foreign exchange restrictions, or additional taxes that are not also levied on U.K.-produced items.

The British Standards Institution has issued specifications covering most electrical products. In recent years these have tended to become aligned with the specifications of the International Electrotechnical Commission in Geneva. In theory, adherence to British specificaitons is not mandatory, but in practice, area boards will not permit installation of equipment that fails to meet British specifications. American-made products are generally acceptable.[1]

Domestic production.—The United Kingdom's electrical equipment industry, which started in the late nineteenth century, was for many years a world leader in its field. Although the industry grew steadily, its share of the world market has been declining for many years. Manufacturers in the United States, Germany and France, have surpassed the British industry in production volume. For example, in 1950 the two largest motor control gear manufacturers were located in the United Kingdom; the largest such local firm now ranks 15th. Under the influence of the British Standard Specifications, U.K.-made electrical equipment pieces have remained relatively heavy, complex, and expensive, and so less competitive in both domestic and foreign markets.

Domestic production still supplies virtually all the equipment used by public utilities. From 1950 to 1965, however, industrial users turned increasingly to American products and subsequently to those of large European manufacturers.

Table 3 lists major U.K. and third-country manufacturers of electrical energy equipment and their principal products. In the world market for diesel generator sets, U.K. firms are particularly active. There are well over 50 significant manufacturers, though the leading 5 account for some 40% of domestic production. Four firms account for 85% of domestic production of alternators, which was estimated at $25 million in 1975. Half of this production was exported, but imports of $7.5 million

[1] Electricity is supplied in the United Kingdom at 230 V/single-phase/60 hertz and 415 V/3-phase/50 hertz. The metric system of weights and measures is currently replacing the imperial system. Dimensions in metric measurements are favored in some drawing offices.

Information on the availability of published standards in the United Kingdom may be obtained from the National Technical Information Service, Technical Help to Exporters, Springfield, Virginia 22161.

Table 2.—United Kingdom: Estimated imports of electrical power equipment, 1973, 1974, and 1979

(in millions of U.S. dollars) [1]

	1973	1974	1979
Generation equipment			
United States	6.6	6.0	5.0
Germany	5.2	4.7	6.0
Netherlands	2.4	2.0	1.5
Japan	2.0	1.7	1.5
France	1.8	1.5	2.0
Switzerland	.6	.5	.5
Other countries	6.0	5.0	6.0
Subtotal	24.6	21.4	22.5
Transmission and distribution equipment			
United States	22.5	20.0	18.0
Germany	21.5	20.0	22.0
France	9.3	9.0	10.0
Switzerland	6.0	6.0	5.0
All others	37.7	35.0	45.0
Subtotal	97.7	90.0	100.0
Totals			
United States	29.1	26.0	23.0
Germany	26.7	24.7	28.0
France	11.1	10.5	12.0
Switzerland	6.6	6.5	5.5
Netherlands	2.4	2.0	1.5
Japan	2.0	1.7	1.5
All others	43.7	40.0	51.0
Grand Total	121.6	111.4	122.5

[1] For exchange rates, see table 1.

Source: U.K. Customs & Excise—1973 records and trade source estimates.

brought the domestic market for alternators to about $20 million.

Domestic production for transformers is estimated as follows: 1 kVA-5 kVA, $20 million; 6 kVA-1,500 kVA, $25 million; 1,500 kVA-7,500 kVA, $14 million; and over 7,500 kVA, $8 million. Four firms are responsible for making 90% of the transformers over 72.5-kV produced in the United Kingdom. Three other firms account for 75% of the output of transformers below this capacity.

Production of switchgear of 3.3-kV to 11-kV capacity was estimated in 1975 at $40 million, while output of switchgear of 33-kV capacity and above was estimated at $55 million. Although Parsons Reyrolle was once the largest switchgear manufacturer in the world, it is now second in the United Kingdom to GEC, which amalgamates the switchgear interests of many merged constituents. Lesser manufacturers are active chiefly in the production of switchgear in the 3.3-kV to 11-kV range, which is in demand by the industrial sector.

With regard to AC generators in the 100-kVA to 1,000-kVA range, the value of domestic production was estimated at $25.5 million, exports at $9.4 million, and imports at almost $20 million in 1974. Total production of new generating sets in 1974 was estimated at 3,100 MVA or 2,500 MW. About 25-30% of this production was exported, while imports supplied 15-20% of the U.K. demand for AC generators. The original equipment manufacturers market for components is discussed in the end-user section below.

End Users

Electric utilities.—The public supply of electricity for the United Kingdom was nationalized in 1947. In England and Wales, the Central Electricity Generating Board (CEGB) produces the supply, which is then distributed by 12 autonomous Area Boards. This system accounts for some 90% of the public supply of electricity for the United Kingdom. In Scotland, power is generated and distributed by two much smaller, largely autonomous boards, one for the South and one for the North. Northern Ireland and the offshore islands have separate arrangements.

In 1973 the CEGB had a plant capacity of 56,450 MW, while the Scottish boards had capacity exceeding 7,700 MW. In 1974 the CEGB generated 215,321 gigawatt hours (GWh) by steam, 583 GHh by hydro, and 895 GWh by other means. The Scottish boards generated 23,051 by steam, 3,743 GWh by hydro, and 427 GWh by other methods. Many of the public utilities' fossil steam stations are of the dual fuel type, capable of switching from oil to coal as needed.

Figure 2 shows an anticipated overall increase of about 5,0000 MW in electric generating capacity during the remainder of the decade to yield a total of 70,000 MW in 1980. However, public supply authorities have reconsidered this forecast in view of the recent decline in power consumption, and official estimates subsequently may be reduced. Although demand in the United Kingdom is not now expected to match installed capacity until the mid-1980's, trade sources predict that expenditures will nevertheless continue at a lower level and that older stations will be closed down before their allotted lifespan. Construction of nuclear and thermal stations can be justified on grounds of increasing efficiency and reducing the need for imported oil.

The United Kingdom's first program for nuclear power stations was authorized in 1955. The eight stations built in this initial effort use gas-cooled, graphite-moderated reactors fueled with solid rods of natural uranium clad in magnesium alloy. The first two were Magnox-type stations, with capacities of 276 MW and 300 MW, came into operation in 1962. Five stations (500 MW-600 MW each) began generating between 1965 and 1967. The last Magnox-type plant (1,180 MW) was completed in 1971.

At the same time, the United Kingdom Atomic Energy Authority built an advanced gas-cooled re-

Table 3.—United Kingdom: Major suppliers of electrical power equipment

Domestic manufacturers

British Nuclear Design and Construction
Nuclear reactors

The Nuclear Power Group
Nuclear reactors

GEC Switchgear Ltd.
Switchgear

Parsons Reyrolle
Switchgear, turboalternators

Babcock & Wilcox
Power boilers

Clarke Chapman
Power boilers

Yarrow
Power boilers

Rolls Royce Motors Ltd.
Diesel engines, large gas turbines

Rolls Royce/Brush
Small gas turbines

Centrax
Small gas turbines

Dale Electric of Great Britain Ltd.
Diesel generator sets (1.75 kW to 2,350 kW)

Petbow Limited
Diesel generator sets (20 kW to 2,063 kW)

Auto Diesels Braby Ltd.
Diesel generator sets (16 kW to 800 kW)

Dawson Keith Electric Ltd.
Diesel generators sets (1 kW to 1,200 kW)

Graham Puttick Ltd.
Diesel generator sets (3 kW to 1,550 kW)

Dupar Pelapone
Specialized diesel generator sets

W. H. Allen Sons & Co. Ltd.
Diesel engines

Crossley-Premier Engines Ltd.
Diesel engines

Petters Limited
Diesel engines

British Polar Engines Ltd.
Large diesel engines and sets

Perkins Engines Ltd.
Diesel engines

Newage
Alternators

Brush
Alternators and transformers (below 72.5 kV)

Markon-Macfarlane
Alternators

BKB
Alternators

Parsons Peebles
Transformers (above 72.5 kV)

Ferranti
Transformers (above 72.5 kV)

English Electric
Transformers (above 72.5 kV)

Bonar Long
Transformers (up to 132 kV)

Foster
Transformers (up to 100 kV)

Distribution Transformers Ltd.
Transformers (below 72.5 kV)

Cummins Diesel
Engines for diesel electric sets

Hawker-Siddeley
Transformers (above 72.5 kV)

Mirrlees Blackstone Ltd. (associated with Hawker-Siddeley)
Large diesel generator sets

South Wales Switchgear (associate of Hawker-Siddeley)
Switchgear (33 kV and below)

ECC (owned jointly by Federal Pacific, U.S., and Hawker-Siddeley)
Motor controls

G.E.C. (licensee of G.E. and Westinghouse)
Gas turbines, turboalternators

Ruston (associated with GEC Diesels Ltd.)
Medium-size gas turbines

Centrax Boilers (licensee of G.E., U.S.)
I.C. turbine blades

GEC Diesels Ltd.
Diesel engines, prime movers

John Brown (license of GE, U.S.)
Gas turbines (all sizes), small turboalternator sets, power boilers

Square D (50% Plessey)
Specialized motor control components

Cutler-Hammer Europa (50% U.S.-owned, incorporates Brookherst Igranic, U.K.)
Specialized motor control components, panels

Allen Bradley (50% U.S.-owned)
Specialized motor control components

Allen of Bedford (incorporating Bellis & Morcom)
Small turboalternator sets

Table 3.—United Kingdom: Major suppliers of electrical power equipment—continued

Third-country manufacturers

Brown-Boveri International (Germany, France, Switzerland)
Large diesel engines and other generation equipment, turbine speed controls, other motor control and distribution equipment

Honda (Japan)
Small generating sets

Telemecanique (France)
Motor control and distribution components

Siemens (Germany)
Motor control and distribution components

Klockner-Mueller (Germany)
Motor control and distribution components

AEG (Germany)
Motor control and distribution components

ASEA (Sweden)
Motor control and distribution components, tap-changers

Metzenaur & Jung (Germany)
Motor control and distribution components

Sprecher & Schuh (Switzerland)
Motor control and distribution components

Reinhausen
On-load tap-change equipment for transformers

Merlin Guerin (France)
Molded-case circuit breakers

Martin Lunel (France)
CEE 17 plugs and sockets

Smit-Slikkerveer (Netherlands)
Alternators

Heemaf (Netherlands, associated with GEC)
Alternators

Source: U.S. Department of Commerce Bureau of International Commerce, Office of International Marketing research study.

actor (AGR) in a power station at Windscale, which it continues to own and operate. The second nuclear program, planned in the 1960's, consisted of five AGR stations, all of which are still under construction. Design problems have delayed their completion.

The third nuclear development program, agreed upon in 1974, features three steam generating heavy water reactors (SGHWR) similar to a prototype in operation at Winfrith for 7 years. Work is scheduled to begin on the first 2,500-MW station of this type in 1976, and all three plants are scheduled for completion by 1985.

Although the United Kingdom has developed advanced designs for nuclear reactors and has had exceptional experience in nuclear power station construction, British manufacturers have been unable to exploit their apparent potential in the European nuclear station market for several reasons. First, the Magnox-type stations were not competitive with coal-fired stations in the 1960's. Secondly, the AGR types developed technical difficulties and failed to demonstrate clearly their superiority over the U.S.-designed light water reactors. From 1965-70, the U.K. heavy electrical industry underwent drastic pruning and mergers which inhibited an aggressive international sales drive. Therefore, the United Kingdom at the time of the energy crisis had neither a clearcut nuclear power station policy nor an agreed-upon design for reactors suitable for export. Only in July 1974 did the Government finally set forth its support of the SGHWR program combined with completion of the AGR program and further work on fast breeder reactors of the 250-MW prototype, Dounreay type.

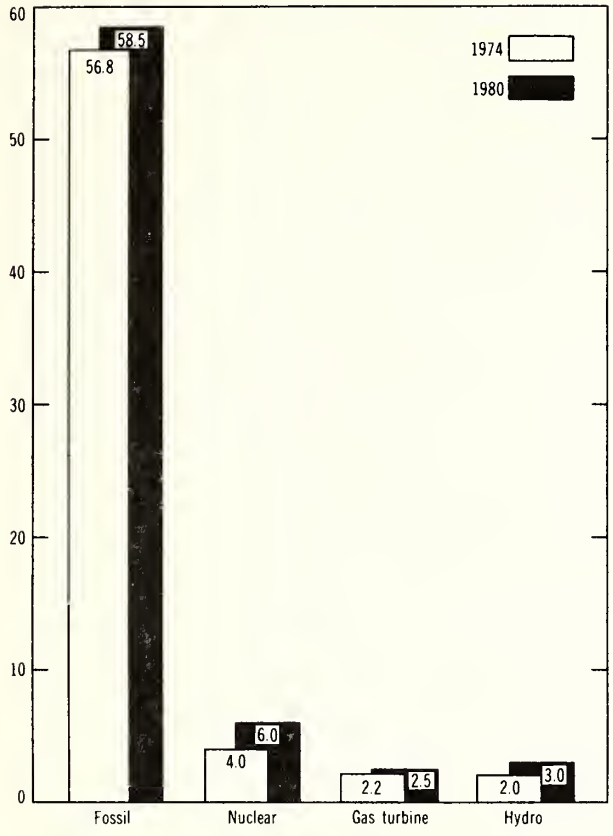
Official plans called for 43 electrical power stations to be under construction or in the process of expansion by 1975. This construction program would increase total power station generating capacity by almost 16,000 MW in 1980. In 1975, however, work on some of these projects had been slowed down and other projects had been cut back, although the Department of Energy granted further consents to the CEGB for power plant construction. Trade sources report that consent does not necessarily lead to construction of the station. Consents granted include those for the three SGHWR nuclear plants mentioned above (combined capacity: 6,300 MW), plus five consents for coal- or oil-fired plants (combined capacity: 11,280 MW) and eight gas turbine stations (combined capacity: 1,500 MW). One pumped storage system (capacity: 1,800 MW) was also approved in December 1973.

Numerous other applications have been filed by the CEGB and the South of Scotland Electricity Board. Although coal and oil were equally plentiful and comparable in price in 1975, work was progressing on converting boilers to dual fuel operation.

Table 4 identifies the types of electrical power equipment and systems expected to be purchased by the public utilities over the next few years. The two most important items, power boilers and nuclear reactors, are predicted to remain in strongest demand throughout the remainder of the 1970's. The market for steam turbine generator sets is forecast to fall off significantly, but consumption of gas and hydraulic turbine generator sets and diesel motor generator sets is expected to remain constant during the same timespan. Demand for switchgear, distribution transformers, and substation transformers is predicted to show appreciable decline, but the market for other transmission and distribution equipment

Figure 2.—United Kingdom: Electric utility generating capacity ,1974 and projected 1980

(in gigawatts)



Source: Digest of United Kingdom Energy Statistics, 1974, and trade source estimates.

is expetced to continue at about the 1974-75 level for some years.

Industrial end users.—Prior to the onset of the strikes in 1972, the area electricity boards offered attractive terms to companies with private generating plants to take their full supply of electricity from the public utility and to scrap their own plant operation. In line with this policy, supplementary supply requests by companies needing more power than they were able to generate were refused by the boards except on confiscatory terms. Because private generation was made uneconomical, it increased at a much slower rate than the national load growth rate.

In 1973, however, industrial companies spent $308 million on electrical energy equipment—largely standby generators—and sales to this sector rose to $385 million in 1974. Although inefficient in comparison to the operation of a power station, the diesel or gas turbine generators in use, which range from 100 kVA to 1 MVA, can justify their fuel costs if used to avoid maximum demand charges.

Table 4.—United Kingdom: Estimated equipment expenditures by electric utilities, 1972-75 and 1979

(in millions of U.S. dollars) [1]

	1972	1973	1974	1975	1979
Generation equipment					
Power boilers	159.0	140.0	117.0	117.0	117
Nuclear reactors	105.0	112.0	117.0	117.0	117
Turbine generator sets					
Steam	173.0	161.0	140.0	117.0	93
Gas	9.3	11.7	11.7	11.7	12
Hydraulic	7.0	9.3	9.3	9.3	9
Diesel motor generator sets.	14.0	18.0	18.7	18.7	19
Total	467.3	452.7	413.7	390.7	367
Transmission and distribution equipment					
Distribution transformers	32.7	30.4	23.4	18.7	14
Small power transformers	4.7	4.7	4.7	4.7	5
Secondary unit substation transformers	14.0	11.7	9.3	9.3	7
Large power transformers	14.0	11.7	9.3	7.0	7
Switchgear	93.0	93.0	82.0	70.0	58
Power circuit breakers	3.5	3.5	2.3	2.3	2
Control circuit relays	1.2	1.3	1.3	1.3	1
Total	163.1	156.3	132.3	113.3	94
Grand Total	630.4	609.0	546.0	504.0	461

[1] For exchange rates, see table 1.

Source: Bureau of International Commerce, Office of International Marketing research study. Values based on official U.K. statistics and trade source estimates.

Additional Information

This Survey is one of a series based on market research reports prepared overseas for the Office of International Marketing. Other detailed marketing information on the United Kingdom is available on a continuing basis from:

Country Marketing Manager—United Kingdom
Office of International Marketing
BIC/DIBA
U.S. Department of Commerce
Washington, D.C. 20230

A copy of the original research which this Country Market Survey summarizes is available at a cost of $10.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

The report includes more detailed information on U.S., foreign, and local firms active in the market; a more extensive assessment of end users and listings of trade publications, trade and professional associations, and major prospective customers. Please request: "The Market for Electrical Energy Systems: United Kingdom." DIB 76-04-516, February 1976.

The area boards now welcome assistance in handling the load during peak periods and have granted consents for peak-lopping sets to operate in parallel with the Board's supply. Hence companies that bought small diesel generators during a power crisis or the 3-day workweek are moving toward installations of higher efficiency, greater size, and more permanent integration into their systems.

The industrial sector also purchases some mobile and portable generating equipment. Rented sets are most in demand at construction sites, but there is also a market for such equipment elsewhere during strikes and breakdowns.

Original equipment manufacturers (OEM).—The OEM sector accounted for about one-tenth of all expenditures for electrical energy equipment throughout the first half of the 1970's and is expected to continue to do so for the foreseeable future. OEM expenditures, which amounted to $82 million in 1975, are expected to total $75 million in 1979. Generation equipment represents an increasing proportion of OEM purchases (up from 78% in 1972 to an anticipated 84% in 1979).

Equipment in demand by the OEM sector includes subassemblies for gas turbines, diesel engines, atlernators, and switchgear (required by set makers), plus automatic control components, instruments, governors, and similar equipment (needed by manufacturers of prime movers and alternators). The best sales opportunities to this sector stem from value of specialized equipment used as part of a complete system. Many U.S. firms have had their products included in bids by British manufacurers in this way.

Licensees and subsidiaries of U.S. companies in the United Kingdom are major importers of sophisticated components. Contracting firms and OEM's in the United Kingdom that export generating sets also import 60-hertz alternators from the United States, where such equipment is in quantity production and may thus be more economical to buy than to make.

Country Market Briefs

Country Market Briefs summarize information supplied by the commercial sections of U.S. Embassies on other important markets for electrical energy systems.

Ecuador

Until this decade Ecuador lagged behind other South American countries in growth of per capita generation capacity. Now the government plans to invest its new oil revenue to meet the urgent needs of the country's developing industrial and rural sectors.

The Ecuadorean energy equipment market is almost entirely supplied by imports, and this should remain true for the foreseeable future. United States manufacturers' sales totaled $27 million in 1971, representing only a small portion of the market, but trade sources believe that with greater effort, they could capture at least 30% of the market. The major suppliers have been British, German and, in particular, Japanese companies. A key to their success has been favorable financing arrangements, which are often a major element of larger bids. Potential importers to Ecuador must remember that law requires all bids be submitted by a local agent, and bid submission procedures are very specific and must be followed exactly.

Electrical power in Ecuador is supplied by the National Electrification Institute (INECEL), a branch of the Ministry of Natural Resources and Energy.[1] INECEL aims to raise its generating capacity from its 1974 level of 490 MW to over 1,250 MW by 1985. The emphasis of this program is rural electrification and industrial supply. A total of $1.8 billion cost is anticipated by 1985, including capital investments of $750 million in hydroelectric-irrigation projects and $165 million in a national transmission system. About 25% of this expense is expected to be financed through foreign sources.

INECEL will build mainly hydro and fossil plants. Transmission and distribution equipment purchases are made by the nine regional boards that distribute INECEL-supplied electricity. Among the most important construction projects planned are: The giant Coca-Quijos Hydroelectric Project, possibly running to $1 billion; the Jabones Hydroelectric and Irrigation Project, costing $29.3 million; the Montufar Hydroelectric and Irrigation Project, costing $15.3 million; the Paute Hydroelectric Project, costing $300 million and designed by International Engineering of the U.S.; Puyango-Tumbez Binational Development Project, a joint undertaking of Peru and Ecuador costing about $200 million; and the $150 million Toachi-Pilaton Hydroelectric Project.

This report is based on information supplied by the commercial section of the U.S. embassy in the Country. The original material may be ordered for a price of $4.00 from:

National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22161
Sales desk Telephone: (703) 557-4650

Please request: "The Market in Ecuador for Electrical Energy Systems," DIB 76-09-047, June 1976.

[1] INECEL is gradually acquiring control of the private utilities serving Quito and Guayaquil, and so their production and expenditures are included in these figures.

Finland

Finnish purchases of electrical power equipment stood at $157 million in 1974. Although the total market is projected to drop slightly from 1974 to 1979, purchases of nuclear equipment will increase, opening important sales opportunities for American manufacturers. The major buyer remains the utilities, but industry is expanding its expenditures on energy equipment.

Imports are projected to grow from 52% to 62% of the total market in 1974-79. Germany, Sweden, Switzerland, and the U.S.S.R. together supply about two thirds of the imported equipment. Twenty-five domestic manufacturers are active in the market. None are foreign-owned but many use licensed foreign technology.

Sales by U.S. manufacturers are projected to grow from about 9 to 12% of both generation and transmission and distribution equipment imports in the 1974-79 period. Best sales prospects are nuclear equipment, back-pressure power plants and instrumentation. U.S. receipts totalled almost $7.5 million in 1974.

Finnish consulting engineers have gained an international reputation for their designs of standard power projects. Nuclear plants, however, are usually designed by foreign and particularly American, firms. Such consulting is generally provided by the equipment suppliers.

The national generating capacity is planned to grow from its 1974 level of 6,747 MW to 15,500 MW in 1979. This expansion will be almost entirely in the area of fossil steam and nuclear plants; hydroelectric generation is already fully utilized in Finland. By 1985 nuclear power should supply one-third of Finland's energy needs. Maior investment in the country's distribution network is also planned.

Anticipated equipment expenditures by utilities in 1979 are: generation—$74.1 million, transmis-

sion and distribution—$52.3 million. Included in current plans are two 440-MW and two 660-MW pressurized water reactors scheduled for completion between 1978 and 1983. This equipment is being purchased from Soviet, Swedish, and local manufacturers.

This report is based on information supplied by the commercial section of the U.S. embassy in the country. The original material may be ordered for a price of $4.00 from:

National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

Please request: "The Market in Finland for Electrical Energy Systems," DIB 76-09-038, December 1975.

Malaysia

A program of continuous expansion has enabled Malaysia to keep ahead of its growing demand for electrical power. Imports of electrical generation, transmission and distribution equipment are projected to grow from their 1975 level of $150 million to $165 million in 1980. Local production stood at only $22 million in 1975, most of which was standard equipment.

United States firms held about 35% of the 1975 market, or $52.4 million. Their largest sales have been: Gas and diesel generators, alternators, transformers, circuit breakers and fittings and various types of instrumentation. Japanese, British, and German manufacturers are their chief competitors.

Government utilities purchase 80% of all equipment sold in this market. Peninsular Malaysia is served by the National Electricity Board (NEB), outlying areas such as Pinang, Sabah and Sarawak by their own, smaller utilities. These utilities combined generated 3,346 million KWh in 1970 and 4,480 million KWh in 1973. NEB alone had a 1976 generating capacity of 1,074 MW, which it plans to expand to 2,750 MW in the next ten years. Presently, about two thirds of its generating capacity is thermal and one third is hydro.

NEB's expansion program calls for construction of 11 new generating plants in the 1976-83 period, all in the 80-120 MW capacity range. This still leaves several important hydro sites available for future development. The country plans for its first nuclear plant to go on line by 1987, with generating capacity of 600 MW.

This report is based on information supplied by the commercial section of the U.S. embassy in the country. The original material may be ordered for a price of $4.00 from:

National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

Please request: "The Market in Malaysia for Electrical Energy Systems," DIB 76-09-040, June 1976.

Nigeria

An influx of oil revenue and ambitious government planning make Nigeria the largest single market in Africa for electrical generation, transmission and distribution equipment. Virtually all of this equipment is supplied by foreign sources. Imports (excluding transmission cables and towers) rose from $41.8 million in 1972 to $96.8 million in 1974. Projections place 1979 import sales at $221.8 million, about evenly divided between generation and distribution equipment.

U.S. manufacturers' share of the Nigerian market fluctuates widely from year to year; in 1972 their sales approached 15% of all electrical equipment imports. American products have a good reputation but only recently became price competitive. Delivery time, safety features, and ease of maintenance are of more importance to buyers than advanced technology or price.

Germany, Italy, and the United Kingdom are the major competitors for Nigerian orders; Switzerland, Japan, and Austria are also represented in the market in purchases of less expensive items. There is no local production of this equipment, although the Nigerian government hopes to initiate manufacture of transformers, at first through a joint-venture arrangement. It is hoped that 10% of future transmission and distribution needs can be met from domestic sources.

The Nigerian electric utility relies heavily on foreign engineering consultants. Canadians have done much of their work, but increasingly other foreign firms including U.S. companies are entering the market. General Electric and Charles T. Main have already won large contracts.

Consumption of electricity in Nigeria has risen spectacularly, and future projections assume a con-

tinuation of this trend: FY 1970—0.9 million MWh; FY 1975—2.4 million MWh; FY 1981—7.2 million MWh. The National Electric Power Authority (NEPA) is the country's principal public utility. NEPA's total generating capacity stood at 690 MW in 1979, half of which went to service the Lagos area.

The utility's 1975-80 construction plans were drawn up as part of the federal government's Third National Development Plan. To boost capacity to 1,740 MW in the Plan period, NEPA will spend $1.5 billion. Major areas of expenditure are: thermal generation—$224 million; hydro generation—$434 million; transmission—$401 million; distribution—$215 million. NEPA plans to increase its transmission/distribution network from 14,000 kilometers (km) in 1975 to 20,000 km by 1980.

Other major purchasers of electric generation, transmission and distribution equipment in Nigeria are state governments. They plan to spend $236 million on rural electrification by 1980; NESCO, the country's only privately-owned electric utility; and some large industrial concerns, especially in the petroleum industry.

This report is based on information in the Commerce publication "Nigeria: A Survey of U.S. Business Opportunities," (May, 1976) which describes all major sectors of the Nigerian economy. Copies may be obtained from any Commerce District Office (listed at the back of this report) or from:

The Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

The order price is $2.60.

Singapore

Investment in electrical generation, transmission and distribution equipment in Singapore rose from $68 million in 1972 to $125 million in 1974. The value of imported equipment stood at $72 million and $135 million in the same years, 20% of which was re-exported to neighboring countries. Japan remains the leading exporter to this market, but its share has fallen from 33% in 1972 to 25% in 1974, giving way to the United States, United Kingdom, and Germany. Domestic manufacture is confined largely to electric wires, cables, and miscellaneous fittings, very little of which is exported.

Sales in Singapore by U.S. manufacturers totalled $18 million in 1974, over double the total for 1972. America's share of the import market for generation, transmission and distribution equipment stood at 13% in 1974. Local trade sources say the percentage could be much higher. Best sales prospects for U.S. firms include generator sets, AC diesel engine-drives over 100 kW and insulated power wires and cables over 601 kW. Singapore has nearly completed its conversion to the metric system, and all imports must conform to that standard.

Eleven government departments and statutory boards are concerned with public supply of electricity. Total generation in 1974 was 3.8 billion kWh. By far the largest utility in Singapore is the Public Utilities Board (PUB). PUB's capital expenditures on electrical projects amounted to $221 million in 1974, divided about equally between generation and transmission and distribution equipment. Over half its generating capacity is produced at the Jurong Power Station. Major projects planned by the Public Utilities Board include: an extensive 230 Kv underground transmission network to connect the city with surrounding islands; second phase construction of the Senko power station; and continued improvements in street lighting.

Major private customers for generation equipment are the nation's shipbuilding, oil and construction industries. Purchases are also made by the 150 or so engineers and contractors in Singapore.

This report is based on information supplied by the commercial section of the U.S. embassy in the country. The original material may be ordered for a price of $4.00 from:

National Technical Information Service
U.S. Department of Commerce
P.O. Box 1553
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

Please request: "The Market in Singapore for Electrical Energy Systems," DIB 76-09-039. December 1975.

Yugoslavia

The Yugoslov government is giving top priority to development of its national generating capacity to meet a rapidly increasing demand for electrical energy. An 11% annual rate of increase in consumption since 1970 has only been met by a 6% annual growth in capacity, so that the country is now

plagued by power shortages and has become a net importer of energy.

Government plans call for channeling 36% of all industrial investment over the next 5 years into this program, doubling generating capacity and constructing a nationwide transmission system.

This includes construction of 20 hydro plants, 25 thermal and only one nuclear during the 1975-80 period. The Yugoslavian government has decided to develop its local coal and hydro power sorrces rather than invest in nuclear plants, which would involve imported enriched uranium. If these plans are met, total generating capacity will rise from 9,100 MW in 1975 to 19,400 MW in 1980 and 27,500 MW 5 years later, at a total estimated cost of $4.1 billion. To accomplish this work, the Government must acquire the sophisticated and large-capacity equipment only offered by foreign manufacturers.

Although Yugoslavian companies produce a wide range of energy equipment, about half of it is exported: large-capacity machinery is generally imported. About 55% of future purchases are expected to come from foreign sources, ranging from 25% of hydro- and transmission-related goods to 75% of thermo-related equipment. Imports of generation equipment amounted to $32.5 million in 1973 and $52.2 million in 1974; purchases of foreign-made transmission and distribution equipment stood at $43.4 million in 1973 rising to $70.4 million the following year. Total imports are predicted to exceed $200 million annually by 1980. West Germany has ordinarily held about 40% of this import market: other important suppliers are Italy, the U.S.S.R. and Czechoslovakia.

U.S. companies have a very good chance to capture a large share of this growing market, both with individual types of equipment not produced locally and with complete, turnkey projects. Opportunities also exist for engineering and consulting contracts and for licensing and joint venture projects with either Yugoslav or third country firms. Products with the greatest sales potential include equipment for hydro plants and transmission equipment. There is also strong interest in coal gasification systems. Many contracts will be let soon so that manufacturers must keep a steady eye on the market; of prime importance to Yugoslav buyers are flexibility, credit terms, use of locally made equipment and cooperation with local firms.

The national electric power supply authority in Yugoslavia was decentralized in 1965 and broken into two separate sectors, one for generation-transmission and one for distribution. The first of these sectors comprises 20 independent enterprises; all are members of the Union of Yugoslav Electric Power Industry (JUGEC), which acts as a coordinating and professional association with no executive authority over its members. Six research institutions, two business associations and one consulting firm are also members. Distribution is handled by 16 independnet organizations, which are grouped into the Federal Committee for Coordination (FCC). Twenty-six bulk users purchase their electrical energy dircetly from the suppliers.

This report is based on information supplied by the commercial section of the U.S. embassy in the country. The original material may be ordered for a price of $5.00 from:

National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22161
Sales desk telephone: (703) 557-4650

Please request: "The Market in Yugoslavia for Electrical Energy Systems," DIB 76-09-048, May 1975.

U.S. Government Services for American Exporters

MARKETING ASSISTANCE AND INFORMATION SERVICES

U.S. Trade Promotion Facilities Abroad

U.S. Trade promotion facilities abroad provide U.S. manufacturers with a unique method of testing and selling in key foreign markets through commercial show rooms established in central marketing areas where the potential for American products is continuous.

Listed below are the 16 U.S. trade promotion facilities located in major cities in Europe, Asia, Australia and Latin America.

AUSTRALIA—U.S. Trade Center
37 Pitt Street
Sydney NSW 2000

AUSTRIA—U.S. East-West Trade Development Office
Prinz Eugen Strasse 8-10
A-1040
Vienna

FRANCE—U.S. Trade Center
123 Avenue Charles de Gaulle
92200 Neuilly
Paris

GERMANY—U.S. Trade Center
Bockenheimer Landstrasse 2-4
D-6000 Frankfurt/Main

IRAN—U.S. Trade Center
61 Queen Elizabeth II Boulevard
P.O. Box 50
Tehran

ITALY—U.S. Trade Center
Via Gattamelata 5
20149 Milan

JAPAN—U.S. Trade Center
Tameike Tokyo Building
1-14 Akassaka, 1-Chome
Minato-Ku
Tokyo 107

American Merchandise Display Center
Sankei Kaikan Building
27, Umeda-Cho, Kita-Ku
Osaka

KOREA—U.S. Trade Center
American Embassy
82 Sejon-Ro
Seoul

MEXICO—U.S. Trade Center
Apartado Postal
M-2805
Mexico City 1, D.F.

POLAND—U.S. Trade Development Center
Ulica Wiejska 20
Warsaw

SINGAPORE—U.S. Trade Center
268 Orchard Road
Yen San Building
Singapore 9

SWEDEN—U.S. Trade Center
Vasagatan 11
Stockholm

TAIWAN—U.S. Trade Center
Taiwan Glass Co. Bldg.
261 Nanking East Road
Taipei

UNITED KINGDOM—U.S. Trade Center
4/5 Langham Place
London W1

U.S.S.R.—U.S. Commercial Office in Moscow
c/o American Embassy
Department of State
Washington, D.C. 20520

Information on exhibitions at trade promotion facilities abroad may be obtained from Country Marketing Managers or Commerce district offices.

Country Consultants

Country Marketing Managers (CMMs) provide U.S. firms with marketing information by specific country, counseling on the preparation of effective marketing plans, aids in selecting best opportunity markets and assistance in participating in Commerce trade promotion activities. The CMM also can assist in obtaining other foreign business information available within the U.S. Government.

In addition, the CMM's receive an enormous quantity of information, both published and unpublished, on their countries. This data comes from private and public sources, American and foreign. It includes periodic reports received from the commercial sections of U.S. Embassies on selected industries or product categories, "best prospects" for sales in the coming year, and new developments and opportunities of special interest to the U.S. business community.

The Country Marketing Manager provides guidance and direction in commercial activities to the U.S. Foreign Service—Department of State, Trade Center Staffs, Commercial Fairs, staffs, and other trade promotion personnel. This includes the planning and implementation of trade promotional activities listed earlier ("Global Marketing Program") within the respective country or countries. The CMM is the focal point in Commerce for the development and implementation of the annual Country Commercial Program, jointly prepared by Commerce and the Foreign Service. This operational planning document establishes objectives and priorities for U.S. Government trade promotion and support of U.S. business by country, and the actions to be undertaken to achieve them.

Popular among American businessmen seeking up-to-date foreign marketing data are the International Marketing Information Series publications (see inside front cover). They are all available through CMMs.

For further information and assistance on marketing abroad, please call or write the appropriate manager (see inside back cover for list).

Export Information Services

The export information services described below can be obtained by contacting the U.S. Department of Commerce, Office of Export Development, Export Information Division, Room 1033, Washington, D.C. 20230, or the nearest of the Department's 43 district offices (listed on inside back cover).

Trade Lists

Names and addresses of foreign distributors, agents, purchasers, and other firms are made available to U.S. firms through a series of trade lists. *Business Firms Trade Lists* cover all commercial establishments in smaller developing countries. State *Trading Organizations Trade Lists* name and describe government-controlled foreign trade organizations in nonmarket economy countries.

World Traders Data Reports

World Traders Data Reports (WTDR's) provide descriptive background information on specific foreign firms. Prepared by the U.S. Foreign Service, the WTDR's include such information as year of establishment, method of operation, lines handled, size of sales territory, name of chief executive, general reputation in trade and financial circles, names and addresses of credit sources, names of the firm's connections, and other commercial information. The complete name, street and city address of the foreign firm must be given when requesting this service. Nominal fee.

Agent/Distributor Service

The Commerce Department's Agent/Distributor Service helps U.S. firms find agents or distributors for their products in almost every country of the world. U.S. Foreign Service Officers overseas will identify up to three foreign firms that express interest in a specific U.S. proposal. The charge for this service is $25. Application forms (DIB-424P) may be obtained from any Commerce Department District Office.

Export Mailing List Service

The Export Mailing List Service (EMLS) provides lists of foreign firms considered prospective customers for U.S. firms. Firms are drawn from the automated Foreign Traders Index. Their names and addresses are available on gummed mailing labels or in standard printout form. Printouts also include: Name and title of an officer, type of organization, year of establishment, relative size, number of employees and sales-persons, and product and/or service codes (Standard Industrial Classification numbers).

The cost of a list comprises a $10 set-up charge and an additional 6¢ per name listed. Delivery can be made in about 15 days.

Foreign Traders Index (FTI) Data Tape Service

This service is offered as a convenience to firms that have a continuing need for a broad range of foreign commercial data, such as export management firms selling a wide range of products. This service provides, in magnetic tape form, information on all firms in one or more countries covered in the Foreign Traders Index. Users may thus retrieve various segments of FTI data by running tapes through their own computer facilities. There is a flat fee for this service on a per-country basis for up to 15 countries. A single, fixed charge is made for a package of 15 or more countries or for the entire file.

Overseas Business Opportunities

The overseas business opportunities services described below can be obtained by contacting the U.S. Department of Commerce, Office of Export Development, Overseas Business Opportunities Divi-

sion, Room 2323, Washington, D.C. or the nearest of the Department's 43 district offices.

Trade Opportunities Program

The Trade Opportunities Program (TOP) receives up-to-date trade leads from U.S. Foreign Service posts around the world and disseminates them to U.S. suppliers. Trade opportunities are based on inquiries by overseas companies that wish to purchase American products or services, or who are interested in representing U.S. firms. Trade opportunities may come from private commercial organizations, from foreign governments, or even from multinational organizations such as NATO or the UN.

To register for TOP, U.S. firms are requested to specify their product and country interests and the types of commercial information desired—direct sales, representation, and/or foreign government tenders. As leads are developed by the Foreign Service, they are cabled to Washington, where they are matched by computer against the criteria established by U.S. companies. These leads are then mailed to appropriate U.S. firms within a week of their origination overseas. Trade leads are charged against prepaid subscriptions.

Overseas Product Sales Group

The Overseas Product Sales Group (OPS) provides personalized assistance to TOP subscribers, or to firms identified as having high export capability, in bidding against foreign competitors for specific export sales opportunities with a value of $1 million or more. The OPS specialists collect, inventory and disseminate early information on export sales opportunities from TOP and a variety of other sources.

Foreign Investment Services Staff

The Foreign Investment Services Staff (FISS) is the focal point for American and foreign business inquiries relating to U.S. investment and licensing abroad. American businessmen are assisted in locating potential overseas licensees and partners, are provided with investment data on specific regions and countries, and then guided toward sources of capital for these proposed projects. Foreign investment and licensing proposals for which U.S. participation and technology is sought are published regularly in *Commerce America* and are brought to the direct attention of American firms where appropriate. In carrying out its broad range of activities, FISS works closely with other U.S. Government assistance sources, multinational agencies and private regional investment organizations.

Office of Export Administration

Information on U.S. export control may be obtained from the U.S. Department of Commerce, Bureau of East-West Trade, Office of Export Administration, Washington, D.C. 20230. Telephone: (202) 377-4811.

FINANCING EXPORT SALES

The Export-Import Bank of the United States (Eximbank) is an independent agency of the U.S. Government which works directly with American suppliers and private financial institutions to finance U.S. export sales. Eximbank has numerous financing programs to assist U.S. firms. These include direct loans, bank guarantees, discount loans to commercial banks, leasing guarantees, and other programs to cover overseas design and engineering studies.

Financing packages for major industrial projects and exports of high value products are normally supported under Participation Financing, a combination of the Direct Loan and Financial Guarantee programs.

Direct Loans are dollar credits extended by Eximbank to borrowers outside the United States for purchases of U.S. goods and services. Disbursements under the loan agreement are made in the United States to the suppliers of the goods and services, and the loans, plus interest, are repaid in dollars by the borrowers.

Eximbank will extend its Financial Guarantee to cover loans made by U.S. financial institutions to foreign government or private purchasers of U.S. goods and services. The Financial Guarantee will unconditionally guarantee repayment by a borrower of up to 100% of the outstanding principal due on such loans plus interest equal to the U.S. Treasury rate for similar maturities, plus 1% per annum on the outstanding balances of the loan. Comparable guarantees are available to non-U.S. financial institutions under somewhat different terms.

Of particular importance to U.S. businessmen is Eximbank's Cooperative Financing Facility program which supports medium-term financing in all major markets. Eligible overseas banks are extended a line of credit for half of the funds needed for each transaction and the cooperating banks provide the other half at local market rates. These banks make credit judgments regarding the customer and can consummate transactions with a minimum of difficulty. Eximbank currently has established approximately 300 such working arrangements with foreign financial institutions (private and public) in over 100 countries.

Eximbank's Commercial Bank Exporter Guarantee program, another activity of special interest to exporters, provides guarantees covering the credit and

political risks of nonpayment of medium-term (181 days to 5 years) export debt obligations purchased by U.S. banking institutions on a non-recourse basis from the exporters. The fee charged for Eximbank's guarantee depends upon (1) the classification accorded the country of import, (2) the length of the repayment terms, and (3) the financial condition of the overseas buyer.

As a general rule, all transactions supported by Eximbank must include a minimum 10% cash payment by the buyer and must have reasonable assurance of repayment.

The Bank is directed by statute to supplement and encourage private capital, not compete with it. Selected product lines and services to designated markets are excluded from the agency's support; however, the overwhelming majority of U.S. export products and markets are covered. Details on the exceptions are available from U.S. commercial banks or directly from Eximbank.

Businessmen are specifically invited to utilize Eximbank's counseling services for exporters, banks and financial institutions seeking financing for U.S. exports. The services include information on the availability of financing within the United States and abroad, as well as on each of the pertinent Eximbank programs.

For additional information, contact the Export-Import Bank of the United States, 811 Vermont Avenue, N.W., Washington, D.C. 20571, or Telex 89-461.

EXPORT CREDIT INSURANCE

The Foreign Credit Insurance Association (FCIA) is an association of 53 stock and mutual insurance companies in partnership with the Export-Import Bank of the United States. It offers a comprehensive selection of credit insurance policies which protect policy holders against loss from failure to receive payment from foreign buyers.

The benefits of this coverage may be summed up as follows:

- It protects the exporter against the failure of the buyer to pay his dollar obligation for commercial or political reasons.
- It enables the exporter to offer foreign buyers competitive terms of payment.
- It supports the exporter's prudent penetration of higher risk foreign markets.
- It gives the exporter greater financial liquidity and flexibility in administering his foreign receivables portfolio.

Who May Be Insured

Virtually any corporation, partnership or individual doing business in the United States is eligible for FCIA coverage. An exporter may apply for a policy for himself or may become insured under the blanket policy of a bank or other financial institution which holds an FCIA policy.

Eligible Products

Foreign sales of all types of industrial, agricultural, and commercial products produced in the United States and of services rendered by U.S.-based personnel are eligible for FCIA insurance.

What Losses Are Covered

Comprehensive FCIA policies protect insureds against nonpayment of receivables due to unforeeable commercial and political occurrences. Commercial risks which are covered include insolvency of the buyer or protracted defaults which may well arise from economic deterioration in the buyer's market area, shifts in demands, unanticipated competition, tariffs, or technological changes. Also covered are defaults due to such buyer problems as increasing expenses, the loss of key personnel, and natural disasters.

Political risks coverage applies to defaults due to governmental action and to political disturbances such as war, revolution, and insurrection. Such events may result in confiscation of the buyer's assets, detention or diversion of shipments, or cancellation of necessary licenses by the United States or by the buyer's country. Also covered is the inability or refusal of the foreign central bank involved to convert the buyer's currency to dollars. Political coverage alone is available for exporters who desire to assume their own commercial risks.

The Policies

The policies offered by FCIA are many and varied. They can be tailored to suit the needs of the individual exporters, service groups, and financial institutions. Aside from a small applicant fee, all premiums are paid only for goods actually shipped.

The Master Policy combines a deductible provision, discretionary credit authority, and once-a-year reporting to provide qualified exporters with lower premiums, independent credit decisions, faster services to overseas buyers, and less paperwork. It is a blanket policy which requires the exporter to insure all or a reasonable spread of his exportation.

The Short-Term Policy is a blanket policy which covers sales on terms of up to 180 days. It provides coverage of 90% for commercial losses and 95% for political losses. A moderate discretionary credit limit is included for each buyer.

The Medium-Term Policy provides 90% coverage

(Political and commercial) for capital and quasi-capital goods sold on terms of 181 days to 5 years. The policy is written on a case-by-case basis so an exporter need not insure all his medium-term transactions as he would under a blanket policy.

The Combination Policy provides short- and medium-term insurance to protect U.S. exporters in transactions with overseas dealers and distributors. It includes flexible coverage for short-term sales and for both inventory and receivable financing.

The Comprehensive Services Policy insures the receivables generated by the performance of services for foreign customers by U.S.-based personnel, or by U.S. personnel temporarily assigned overseas. Industries benefiting from this coverage include management consultants, engineering and related construction consulting services, and transportation companies.

Special Coverage Endorsements are available in addition to the above policies. These include endorsements to cover specified preshipment risks and consignment selling.

An Aid to Financing

FCIA does not finance export sales. However, the exporter who insures his accounts receivable against commercial and political risks is usually able to obtain financing from commercial banks and other lending institutions at lower rates and on more liberal terms than would otherwise be possible.

Prequalification of Buyers

FCIA's rapidly expanding prequalifying (P.Q.) program is now providing credit information on overseas buyers through its computerized data system. All the exporter needs to do is telephone the nearest FCIA office to determine whether a particular buyer is prequalified for the amount of his purchase.

Information about FCIA

More information about FCIA's services, and applications for policies, may be obtained through insurance agents or brokers or through FCIA's network of full-service regional offices. General questions and specific inquiries may be directed toward the FCIA Ombudsman in the New York office. Call (213) 432-6216 for a direct connection.

FCIA Offices

One World Trade Center—9th Floor
New York, New York 10048
Phone: (212) 432-6200

1250 South OmniInternational
Atlanta, Georgia 30303

Suite 1552
10 South Riverside Plaza
Chicago, Illinois 60606

Suite 1300
55 Public Square
Cleveland, Ohio 44113

Suite 1790
611 West Sixth Street
Los Angeles, California 90017

Suite 1110—First Federal Bldg.
700 North Water Street
Milwaukee, Wisconsin 53202

C&I Building—Suite 1408
1006 Main Street
Houston, Texas 77002

Suite 205
1 Embarcadero Center
San Francisco, California 94111

Woodward Building, Suite 420
15th & H Streets, N.W.
Washington, D.C. 20005

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Commerce District Offices

Albuquerque, 87101, (505) 766-2386.
Anchorage, 99501, (907) 265-5307.
Atlanta, 30309, (404) 526-6000.
Baltimore, 21202, (301) 962-3560.
Birmingham, Ala., 35205, (205) 254-1331.
Boston, 02116, (617) 223-2312.
Buffalo, N.Y., 14202, (716) 842-3208.
Charleston, W.Va., 25301, (304) 343-6181, Ext. 375.
Cheyenne, 82001, (307) 778-2151.
Chicago, 60603, (312) 353-4450.
Cincinnati, 45202, (513) 684-2944.
Cleveland, 44114, (216) 522-4750.
Columbia, S.C., 29204, (803) 765-5345.
Dallas, 75202, (214) 749-1515.
Denver, 80202, (303) 837-3246.
Des Moines, 50309, (515) 284-4222.
Detroit, 48226, (313) 226-3650.
Greensboro, N.C., 37402, (919) 275-9111, Ext 345.
Hartford, 06103, (203) 244-3530.
Honolulu, 96813, (808) 546-8694.
Houston, 77002, (713) 226-4231.
Indianapolis, 46204, (317) 269-6214.
Los Angeles, 90024, (213) 824-7591.
Memphis, 38103, (901) 521-3213.
Miami, 33130, (305) 350-5267.
Milwaukee, 53202, (414) 224-3473.
Minneapolis, 55401, (612) 725-2133.
New Orleans, 70130, (504) 589-6546.
New York, 10007, (212) 264-0634.
Newark, N.J., 07102, (201) 645-6214.
Omaha, 68102, (402) 221-3665.
Philadelphia, 19106, (215) 597-2850.
Phoenix, 85004, (602) 261-3285.
Pittsburgh, 15222, (412) 644-2850.
Portland, Ore., 97205, (503) 221-3001
Reno, 89502, (702) 784-5203.
Richmond, Va., 23240, (804) 782-2246.
St. Louis, 63105, (314) 425-3302.
Salt Lake City, 84138, (801) 524-5116.
San Francisco, 94102, (415) 556-5860.
San Juan, P.R., 00902, (809) 723-4640.
Savannah, 31402, (912) 232-4204.
Seattle, 98109, (206) 442-5615.

Country Marketing Managers

Commercial and economic information on most trading partners of the United States is available from the Bureau of International Commerce, U.S. Department of Commerce.

The Bureau is organized geographically with a Country Marketing Manager responsible for a country or group of countries as listed below. Assistance or information about marketing in these countries may be obtained by dialing these key people directly: 202-377 plus the given extension.

Area	Extension
Africa	3865
Europe	
France and Benelux Countries	4504
Germany and Austria	5228
Italy, Greece and Turkey	3944
Nordic countries	3848
Spain, Portugal, Switzerland and Yugoslavia	2795
United Kingdom and Canada	4421
Far East	
Australia and New Zealand	3646
East Asia and Pacific	5401
Japan	2425
Southeast Asia	2522
Latin America	
Brazil, Argentina, Paraguay and Uruguay	5427
Mexico, Central America, and Panama	2314
Remainder of South America and Caribbean countries	2995

Special units within the Department of Commerce have been created to deal with particular marketing situations:

Commerce Action Group for the Near East	
North Africa	5737
Near East	
Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Peoples Democratic Republic of Yemen, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen Arab Republic	5767
Iran, Israel, Egypt	3752
Bureau of East-West Trade	
Eastern Europe	2645
USSR	4655
Peoples Republic of China	3583